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ABSTRACT

This master plan sets forth a general strategy for providing administrative and academic computing services and satisfying the data processing requirements for the Virginia Community College System (VCCS) during the 1980's. Following an executive summary, chapter 1 sets forth the purpose of the plan and outlines the planning processes used. Chapter 2 discusses the mission of the VCCS and the role of the computing and data services functions. After chapter 3 establishes guidelines for the VCCS computing services system, chapter 4 provides an analysis of the present situation and existing resources. Chapter 5 looks at assumptions related to the provision of computing services while chapter 6 considers current strengths, weaknesses, opportunities, and problems. The goals of computing services are reviewed in chapter 7, followed by an examination of computing and systems development strategies in chapter 8. Chapters 9 and 10 present organizational, personnel, and financial requirements of the proposed system, and chapters 11 and 12 address the implementation, management, and coordination of the master plan. Performance standards are set forth in chapter 13, followed by a discussion of plan management in chapter 14. Appendices include information on administrative, management, and academic applications; network requirements; service request procedures; hardware and software; time lines; and a glossary of data processing terms. (LAL)

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MASTER PLAN

for the

Virginia Community College System

Computing Services

by

The
Virginia Community College System

Including
Data Services Staff
and the
VCCS Computing Services Planning Committee

May 1981

JC 840 105

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ACKNOWLEDGEMENT

"The purpose of the planning effort is not just to develop 'a plan' but to insure that planning becomes a routine ongoing part of the organization's management process."[1] As such the Master Plan for the Virginia Community College System Computing Services represents the successful culmination of an extensive planning effort and the beginning of a brave new direction for Data Processing in the VCCS.

Though it is impossible to acknowledge all the many contributions to this process, I would at least like to personally thank the major participants in this fine effort. Firstly, the VCCS Data Services Task Force provided a great deal of valuable insight through the development of a comprehensive task force report that helped to focus preliminary strategies. This effort was then dramatically transformed into an ongoing process of concensus building, guideline determinations, and development of a comprehensive Plan based on reason, cost effectiveness, and flexibility with a keen eye for the present and future needs of the students of the VCCS. This was accomplished as a result of a combined effort between the VCCS Computing Services Planning Committee and the VCCS Data Services whose untiring efforts and commitments resulted in a common, unified direction for computing in the VCCS for the 80's. Finally, the involvement of the presidents and the colleges cannot be understated for it is with their keen insight, contributions, and continued cooperation that this Plan can and will succeed.

I also wish to extend my gratitude to the Department of MASD and the Department of Telecommunications whose counseling and involvement in this process have helped to insure the reasonableness and technical merits associated with the Plan.

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[1] From "Guidelines for Successful Planning," a presentation by James F. Kingsley to the Commonwealth of Virginia and upon whose planning methodology this Plan is based.

Additionally, I would like to thank the local Hewlett-Packard and IBM companies for their valuable contributions to this planning effort. This Plan was printed by an IBM 6670 Laser Printer in combination with the University of Waterloo SCRIPT text formatting package as a demonstration of current computer printing and word processing technologies.

I commend to you the Master Plan for the Virginia Community College System Computing Services and add my personal support to the unanimous commitment of the twenty-three college presidents to this Plan. It is my sincere hope that this effort to provide adequate and equitable support for data processing services and requirements will allow the VCCS to better serve the students and citizens of the Commonwealth of Virginia.

James H. Hinson, Jr.
Chancellor

EXECUTIVE SUMMARY

The purpose of an information system is to facilitate the achievement of an organization's goals and objectives more effectively and efficiently than otherwise possible. Management of complex organizational environments is dependent upon receiving timely, accurate information from data systems that support organizational activities. The success of information systems which serve such complex environments is, in one sense, measured by the degree to which the systems mirror an organization's existing lines of communication and sustains organizational unit functions. This Plan which is the result of an ongoing part of the VCCS management process attempts to provide such a correspondence between the Computing Services System and the organization of the Virginia Community College System.

The VCCS Computing Services Master Plan sets forth the direction for providing computing services and satisfying data processing requirements for the Virginia Community College System during the decade of the 80's. Computing Services includes resources for both administrative and academic computing. Further enhancements of the Plan will elaborate on academic computing and will provide planning for both word processing and microprocessing. Generally, the Plan provides a review of current VCCS computing capabilities and deficiencies, presents the VCCS strategy for meeting in an effective and cost efficient manner the future computing services requirements of the System Offices and the colleges, and establishes a preliminary working calendar for implementing the strategy. The Plan encompasses the overall system for the remainder of the 1980-1982 biennium and the 1982-1984 biennium. The general narrative also attempts to describe the 1984-1986 biennium but the major thrust of the Plan will involve the next two biennia.

The initial configuration displayed in the Plan was developed to illustrate the distribution of processing power and to permit cost comparisons of hardware alternatives. The actual hardware configuration will be developed through benchmark simulations in the Request for Proposal process to be initiated immediately after the Plan is approved.

The major part of the distributed network will evolve during the next three years. During this time period, July 1, 1981 to June 30, 1984, it is anticipated that significant upgrades in hardware will be necessary at some centers and the network structure itself may require modification to ensure adequate computing services.

This system-wide Plan will not preclude the necessity for colleges to provide local or cooperative computing services plans, since such details are the responsibility of the colleges. The Plan will present system-wide goals, objectives, and parameters within which colleges will be expected to operate and by which the colleges will coordinate their data processing planning.

It must be recognized that the Virginia Community College System is an extremely complex organization which will require close coordination by System Offices staff. The VCCS Executive Management Philosophy includes the statement that:

> the VCCS central staff (System Offices) shall focus on management review and oversight functions thereby delegating maximum authority to presidents for the day-to-day management of the individual colleges.

This philosophy provides a basis for functions at both the System Offices and the local colleges. The System Offices will provide system-wide planning, develop policies and procedures, conduct audit reviews, and provide management oversight. College presidents, on the other hand, are accountable for all other aspects of the decision-making, including those management decisions that pertain to individual college data processing operations.

A computing services system that best approximates the VCCS organization is a distributed processing environment with coordinated shared systems development. Traditionally, the centralized approach to both systems development and information processing has been deemed to be more efficient. Given major recent advances in state-of-the-art computing technology, coupled with the VCCS management philosophy to develop college oriented applications, a model of shared systems development and distributed processing appears to be the most cost effective solution in providing comprehensive computing services throughout the VCCS.

Effectiveness is currently a key issue in VCCS information processing. Additionally, the degree of committment is a vital concern with the VCCS, and both colleges and the

System Offices are much more committed to a compatible distributed network which allows coordinated shared systems development than to total centralized systems development and information processing. This planning document will, therefore, concentrate on the planning and strategy for the development of a comprehensive distributed processing system for the VCCS. Various alternatives such as highly centralized processing, continuation of a dual system approach, as well as a distributed network are explored within the Plan.

There are certain qualities that will be associated with the development of this Plan. Among these qualities, "flexibilty", "sharability" and "non-duplication" will be fundamental to the development of a distributed computing services system for the VCCS. Compatibility, another quality, will also be required at both the program and hardware levels. This may require an alteration in the functions of existing equipment and a reduction in the support of such equipment. Computer programs may require consolidation and/or conversion to programs that can be used by the entire system. It should be noted that some additional cost will be associated with this effort but the future realization of cost savings and benefit cannot be denied.

A phased approach will be used in establishing a distributed processing system for the VCCS. A startup phase (Phase 0) will involve the establishment of a regional processing Test and Services Center. The next phase (Phase 1) will involve the establishment of a a similar center at Northern Virginia. Other centers which will serve as cooperative processing centers for groups of colleges or local Remote Job Entry sites are also to be established or enhanced during the early phases of the network. This phase is expected to begin during the latter part of 1981 and to be completed within the year. The Test and Services Center staff will install system software for the network and transfer software intact to other processing centers. The regional centers will also serve as the primary bases for systems development for the network and academic computing for the colleges.

The next phase (Phase 2 encompassing approximately one year) may involve the establishment or enhancement of a third[1] regional center and the installation or enhancement of a

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[1] While the planning model described in this Plan primarily covers two regional centers, recent findings from the Networking Task Force indicate that a third regional center might be more appropriate due to a need for load balancing and to effect reductions in telecommunications.

minimum of three to four other geographically placed processing centers. Initial efforts will begin during this phase to reduce processing at the Consolidated Computer Facility.

The next phase (Phase 3 - expected one year duration) will include the installation of the remainder of the college processing centers and Remote Job Entry sites and the implementation of a comprehensive network of processing centers.

Later phases may include the establishment of additional centers if they are cost effective. An evaluation of the then current computing network will also be conducted and performance criteria will be examined to determine effectiveness of computing strategies.

The primary phases should be completed by the end of the 1982-1984 biennium. It should be noted that with the rapidly decreasing cost of computer processors and the increasing costs of telecommunications, it may be advisable to place processors at most colleges and/or campuses in the not too distant future. This Plan, while not advancing a more general distribution of processors than those recommended, does not preclude such justifiable installations after the essential network has been completed. In fact, it might be prudent to establish additional processing centers rather than significantly increase the size of existing centers where feasible. It is also envisioned that as satellite communications continue to grow that the VCCS may eventually evolve into a local network encompassing the entire system.

Services provided through the existing Consolidated Computer Facility, currently being shared by the Virginia Commonwealth University and the VCCS, will be phased down. As this reduction occurs at the Consolidated Center, applications and functions will be transferred to the VCCS Test and Services Center or to the colleges.

System-wide systems development for the VCCS has always been rather sensitive since it is so closely tied to the establishment and placement of personnel. A strategy is included in this Plan for the immediate use of existing personnel, as currently located, for present developmental needs through shared resources. The strategy calls for a complete review of the shared development approach for system-wide administrative applications after the initial phases have been completed. If shared development does not prove to be successful, future system-wide development and maintenance must occur centrally. Additional system-wide development personnel will be considered on the basis of how positions support the direction of this plan. An appraisal

is made about what can be accomplished with current resources and with additional resources.

Overall management responsibility of the VCCS Computing Services System resides with the Chancellor of the VCCS and with the State Board for Community Colleges. The Chancellor has shown active interest and involvement in this Plan and has assigned it priority status. He is well aware of the direct correlation between the success of this Plan and the support of his office, and he has demonstrated such support. This plan will also become an essential part of the overall VCCS Master Plan. Various user and policy committees will continue to serve as recommending bodies to the VCCS management and provide user input regarding computing services. The Director of Data Services will coordinate all activities of the VCCS Computing Services System and will serve as the common thread binding the various groups and factions.

The vehicle for providing VCCS computing services will entail the use of regional or localized hardware cooperatives formed among colleges for the purpose of sharing processors and functions. The local cooperatives will be managed by member colleges.

This Plan includes a preliminary cost analysis that was derived through an informal request-for-information to representative vendors. This was accomplished for the purpose of narrowing the scope of alternatives and was not intended to be a final report. Various cost alternatives submitted by vendors are included in the appendices. After approval of this Plan by responsible bodies and agencies, an analysis will be made of the information provided for the purpose of developing a formal request-for-proposal through the Department of MASD. The request-for-proposal will then be distributed, and a final choice of systems and vendors will be made by mid 1981.

This Plan is a dynamic document that will be continually updated to reflect changes in technology and environments. The substance of the Plan, however, is not expected to change. A formal Plan will be submitted on an annual basis to conform to budgetary cycles.

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Chapter 1

VCCS MASTER PLAN FOR COMPUTING SERVICES

1.1 INTRODUCTION

1.1.1 Purpose of Plan

The purpose of this Master Plan for Computing Services, hereafter called the "Plan", is to present a general computing services strategy for the management and development of computing services that support VCCS-college administrative and academic computing. This Plan will address applications to support college processes, management decision making, reporting, and instructional support, taking into account trends in data processing and computer technology.

The Plan contains a history; an analysis of the present situation; an executive management philosophy; a computing services strategy which reflects this philosophy; distributed processing configurations; a general description of administrative, management and academic applications; cost analysis of alternatives; a cost benefit study; and an implementation plan. In a sense, we would have a plan as one of the purposes of the Plan.

1.1.2 Planning Process

It is intended that the Plan, as it evolves, be dynamic, i.e. responsive to changing conditions. The substance of the Plan, however, is not expected to change.

Updating the Plan will be the responsibility of the VCCS Computing Services Planning Committee. The Committee derives its authority from the Chancellor and serves at his pleasure. All actions of the Committee take the form of recommendations to the Chancellor through the Vice Chancellor of Academic Affairs and Planning.

The Committee will adopt operating procedures to monitor the following aspects of the Plan:

1. Currency - The Plan will continually reflect a framework for computing services which is consistent with the VCCS Executive Management Philosophy.

2. Acceptability - The Plan exists in a multi-institution and a multi-agency environment which dictates the scope of mutual acceptability. The Committee will remain sensitive to these limitations and maintain the Plan within them.

3. Revision - The Plan is to be reviewed and updated by the Committee each September. Each year the updated Plan must be approved by the Chancellor and published by October to support relevant budgeting cycles.

Chapter 2

MISSION OF THE SYSTEM

The Master Plan for Computing Services is intended to direct The Virginia Community College System's computing activities so that they support the VCCS mission adopted by the State Board for Community Colleges on April 21, 1976 and amended on November 11, 1978.

2.1 MISSION OF THE VCCS

The mission of the Virginia Community College System is to function within the total educational community, in those areas assigned to it by law, to assure that all individuals in the Commonwealth of Virginia are given a continuing opportunity for the development and extension of their skills and knowledge at a low cost. Emphasis is placed on occupational-technical education, counseling, and guidance. Transfer, developmental, continuing education and community service programs are an integral part of the mission and provide vital services.

The Virginia Community College System produces trained individuals through a cooperative effort with industry, business, professions, government and other educational institutions.

The mission shall be accomplished primarily through the operation of comprehensive community colleges throughout the Commonwealth, supported by the Virginia Community College System Offices. Individual colleges shall offer programs of instruction through the Associate Degree level designed to respond to the needs of the Commonwealth and to the particular needs of the persons and institutions of the region in which they are located. Within The Commonwealth, each college serves a designated geographic region which represents the colleges's campus.

2.2 VCCS COMPUTING SERVICES SYSTEM FUNCTIONS

The VCCS Computing Services System will support the data processing requirements related to the VCCS mission and adhere to the VCCS Executive Management Philosophy of distributed responsibility and central oversight and review through the establishment and operation of a compatible distributed computing environment which reflects current technology. The VCCS Computing Services System will satisfy data processing requirements for both academic and administrative applications in a timely and comprehensive manner.

The VCCS Computing Services System will provide useful, efficient, and cost effective data processing resources and services to the colleges and the System Offices for the ultimate benefit of students within the Virginia Community College System. Using shared development and distributed processing, the VCCS Computing Services System will attempt to maximize the desired result and increase user satisfaction of the development of applications and use of equipment. Through the efficient utilization of resources, the Computing System will address external and internal reporting requirements on a system-wide basis, where appropriate, to reduce redundancy. The Computing System will, however, provide the flexibility for colleges to meet ad hoc requirements on an individual basis for applications that are neither feasible nor desirable on a consolidated basis. Utilizing shared software, networking, and centralized testing and servicing, the Computing Services System will increase the ratio of effective work to the energy expended to develop, maintain, and enhance applications and operating systems resulting in a cost benefit to the Commonwealth.

2.3 VCCS DATA SERVICES FUNCTIONS

Data Services will support the VCCS mission and serve as an agent on behalf of the colleges and System Offices, assisting in efforts to provide the necessary data processing information to meet administrative and academic computing needs for the entire VCCS. Data Services will plan, recommend, and facilitate the procurement of resources for the VCCS Computing System, and will coordinate the interactions between colleges and other agencies that

approve resources, appropriate funds, or are charged with the responsibility for verifying adherence to state policy in relation to computer resources.

Data Services will review and recommend data processing policy and will establish standards and guidelines derived from such policies. Data Services will provide management, oversight and audit review to insure compliance with data processing policies and procedures.

Data Services will provide data processing services to the colleges and will support each college in acquiring adequate computing resources, and will coordinate the sharing of knowledge, resources, and expertise throughout the VCCS. Data Services will insure that the VCCS is provided with quality information systems that are developed or obtained in a timely cost effective manner, without duplication of effort, and with the ability to satisfy all internal and external reporting requirements.

2.4 COLLEGE FUNCTIONS WITHIN THE VCCS COMPUTING SERVICES SYSTEM

Colleges within the VCCS Computing Services System generally function as both active users and contributors to the VCCS Computing Services System. Colleges have either a computer processing center of their own that is integrated into the overall system or are part of one or more cooperatives that share actual processing centers housed locally or remotely. All colleges have the capability of obtaining computing services from a central host. In addition to certain colleges acting as hosting centers, some colleges will fulfill a major leadership role in shared systems development which is to be coordinated by VCCS Data Services. In all cases, each major systems development effort will involve a user project team comprised of both colleges and System Offices staff. When possible, the leadership for a systems development project will depend on the most qualified and knowledgeable person. This approach will be followed in both the user project teams and the technical support teams.

Chapter 3

GUIDELINES FOR THE VCCS COMPUTING SERVICES SYSTEM

The following guidelines and constraints related to the Automated Data Processing policy for the provision of computing services to the VCCS were recommended by the Advisory Council of Presidents to the Chancellor at the June 18, 1980 meeting and are hereby approved. They form the basis for the development of this plan.

1. Existing VCCS data processing plans will be used as a foundation for the completion of a revised Master Plan for VCCS Computing Services. This plan will be developed through a joint venture between the System Offices and the colleges and reviewed by the VCCS Computing Services Planning Committee for recommendation to the Chancellor and Advisory Council of Presidents. The Department of MASD and the Secretary of Education will be involved in this process. Top priority will be given to this project and resources will be required from the colleges and System Offices.

2. The VCCS Computing Services System will be based on maximum sharability of applications and hardware, efficient utilization of resources, non-duplication of effort, and cost effectiveness; and it will allow for controlled growth based on realistic goals and requirements.

3. The VCCS Computing Services Network will be a distributed network of compatible computing equipment with a moderately-sized Central host serving the System Offices, with regional centers supporting administrative systems development and academic computing, and with computing centers supporting day-to-day college operations. The network must be designed to provide the capability for applications to be resident at the individual colleges or at the regional centers but remain accessible to all users in the network. The network must also allow local centers, including the System Offices, to serve as backups to other centers in case of disaster or critical problems.

4. The System Offices will concentrate on total system-wide planning, management oversight, and audit of the VCCS Computing Services System. The role of the System Offices will include active coordination of the development of system applications.

5. Hardware and software resources will be located according to the needs of the overall system. Colleges having similar needs and that are in close proximity will form cooperatives to utilize designated hardware and software resources. Each Cooperative will have a Steering Committee consisting of a representative from each member college appointed by the college president. The Steering Committee will be responsible for coordinating the activities of the cooperative. The Director of VCCS Data Services will participate as an ex officio member on each Steering Committee.

6. No significant growth in Data Processing personnel is anticipated at the System Offices or the colleges during the 1980-1982 biennium. Due to this personnel constraint, careful consideration will be given to maximizing efficiency and in researching other mechanisms (e.g. contractual services, available applications, canned packages, etc.) for providing requirements at both the colleges and System Offices. Since some change in responsibilities is anticipated at the System Offices and colleges, consideration will be given to reclassifying existing personnel according to appropriate job responsibilities after completion of the Position Descriptions section of the Master Plan.

7. Existing applications/hardware will be considered in the development of the VCCS Computing System.

8. Funds for distributed computing equipment will be somewhat limited during the 1980-1982 biennium but should be moderately available during the 1982-1984 biennium.

9. There will be an effort within the VCCS Computing Services System to develop or acquire applications to support administrative needs of the system.

10. Development of administrative applications for the Computing System will be completed for the VCCS in a modular fashion. A single programming effort will incorporate the Colleges' and VCCS common data elements and provide the latitude for ad hoc customized programming procedures that will meet individual college needs.

11. All incompatible computer equipment in relation to the overall Computing System will be continued/and or enhanced only to the point of surviving ongoing operations during the 1980-1982 biennium. No major growth will be approved.

12. Incompatible computing equipment will be gradually phased out of the administrative area and may be used, depending on their cost effectiveness, for academic computing beginning in the 1982-1984 biennium.

13. No new development or major enhancements of applications that have system-wide implications will be conducted unless they can be ultimately shared by the entire system.

Chapter 4

ANALYSIS OF THE PRESENT SITUATION

4.1 HISTORY OF THE VCCS

VCCS's initial computer was a first generation NCR 315 acquired in 1967. The first application programmed was a basic accounting system that automated existing manual procedures and produced state mandated reports regarding, e.g., requistions, vouchers, and budgets. Later, the VCCS payroll was automated to print check stubs and various related payroll reports in more detail than was previously available. In 1969, the NCR 315 was replaced by a NCR Century 200 which had magnetic tape and disk capabilities. Installation of the new computer required a sizable effort to convert all existing programs.

During 1969, meetings were held between the System Offices and several colleges to determine data elements needed to report enrollment statistics. The data processing staff at the System Offices designed and programmed a system to process enrollment cards and produce enrollment reports for the colleges. This system was implemented Summer Quarter, 1969. Enrollment input cards and edit reports were mailed back and forth between the System Offices and the colleges, and this tedious process made it impossible to meet various State Council on Higher Education in Virginia (SCHEV) deadlines. Later, all colleges acquired remote terminals, and the enrollment processing system was run via Remote Job Entry (RJE).

From 1970 to 1972, efforts were concentrated in two areas:

1. Adding new administrative reports and enhancing existing ones

2. Developing and implementing the Student Information Packages (SIP)

The output report design for the SIP was patterned after a system developed at Thomas Nelson Community College that was being run on their IBM 1130 computer. The System Offices staff rewrote the programs to run remotely on an IBM S/360 located at the College of William and Mary and then presented SIP to each college. One by one, the colleges implemented SIP with the assistance and guidance of System

Offices' personnel. Today, all colleges except Northern Virginia Community College are still using SIP to produce many student-related reports. In 1977-78 the colleges with Hewlett-Packard (HP 3000) computers developed new procedures that provide for on-line updates and inquiries against local student and class files and are '99%-plus' independent of the central SIP programs at this time.

In 1970, the McManis Associates consulting firm of Washington, D. C., was engaged to study the management information needs of the VCCS. In November, 1972, they presented a final report outlining a comprehensive VCCS Management Information System (MIS) plan which recommended that 24 subsystems should be implemented. It was further recommended that additional data processing professionals be added to the VCCS staff and that an upgrade of equipment in both the System Offices and most colleges would be required to support the proposed MIS plan. In late 1973, an IBM S/370 145 replaced the NCR Century 200.

In 1973-74, all colleges obtained RJE terminals which allowed direct interface with the IBM S/370 145. Currently, ten colleges have slow, non-intelligent terminals and five colleges have faster versions of RJE equipment. Other Colleges have stand-alone systems that are also used as RJE terminals. There has been increased interest in Microcomputers for academic support and approximately 15 of the 23 colleges have some type of Microcomputer installed.

Colleges with stand-alone computers have evolved from earlier machines such as the IBM 1130's acquired by Thomas Nelson Community College, Virginia Western Community College, and Central Virginia Community College in 1969-70 and upgraded to HP 3000's in 1977. Northern Virginia Community College acquired a small Honeywell System in 1966, upgraded to an IBM S/370 135 in 1974 and purchased an IBM S/370 138 in 1977. John Tyler Community College's NCR Computer acquired in the late 1960's was replaced in the early 70's by an IBM System 3. Tidewater Community College's HP 3000's replaced it's orignal General Automation computer. Paul D. Camp Community College originally installed an IBM System 3 which has been replaced by a UNIVAC UTS 700 which is used for RJE to the Center and also as a stand-alone system.

Several colleges have independent micro- and mini-computers which do not interface with the Center and which are used to support classroom instruction in the Math and Engineering curricula. The largest such mini-computer installation devoted to classroom instruction is the TICCIT System installed at Northern Virginia Community College's Alexandria Campus (see Section III.A for more details)

Since VCCS's central data processing staff has never been large enough to support developmental efforts of the magnitude required to implement a comprehensive MIS (the total level increased from 15 to 27 over the period 1972-1977), it was necessary to utilize consultants extensively. In 1973, VCCS contracted with Systems Engineering Corporation (SEC) to assist in the NCR to IBM conversion which required approximately six months. Upon completion of the NCR to IBM conversion, Computer Sciences Corporation (CSC) was engaged to develop and implement the MIS Accounting subsystem. CSC personnel were used for approximately three years, and during that time they also assisted in the initial development phase of the MIS Admissions subsystem.

In 1974, W. E. Grubbs & Associates Consultants began work on the Personnel/Payroll subsystem. In the first phase of this project a conceptual design document was developed, and subsequently Grubbs was awarded a contract to do the associated programming and system implementation. Due to budget constraints, long approval cycles, the State's new personnel (PMIS) system implementation, and a steadily deteriorating relationship with the consultants, this project was not successful. In 1977, when Grubbs' contract was terminated, VCCS received partially completed programs and some procedural documentation but not an operational Personnel/Payroll subsystem.

In July 1976, a merger of the VCCS and the Virginia Commonwealth University (VCU) computing resources was directed by MASD. Effecting this consolidation and making the associated program conversions required the dedication of most available VCCS data processing resources and halted all developmental efforts except that which was being done by Grubbs. The VCCS/VCU Consolidated Facility (the Center) originally was envisioned as being served by a single IBM S/370 158 which proved to be insufficient to handle the combined workload. VCCS's existing IBM S/370 145 had to be retained and was upgraded in September, 1977, to an IBM S/370 148. The 158/148 configuration remained until July, 1978. The operating software was upgraded to IBM's MVS software during this time. The total core available was seven megabytes. The Center was plagued with problems related to scarce resources (core, processing cycles, disk, and tape), software instability, personnel shortages, turnover, and management structure.

In an attempt to solve some of these problems, an additional two (2) megabytes of memory was added to the IBM 158 in July 1978. This still was not sufficient computer power and in December 1979, the IBM 148 was replaced by an IBM 3031. The 3031 was added at the same time the Consolidated Center was relocated from the VCU Business building to the Richmond

Plaza building. The Data Center Administrator, on board since January, 1978, made some improvements in many areas, but personnel turnover and capacity-related problems continued to exist. During the period from 1976 to 1977, three key people directly involved in the MIS development, the Director of MIS, the Manager of the Computer Center, and a very knowledgeable software technician, resigned. These positions remained unfilled for approximately thirteen months. The remaining staff concentrated its efforts on maintaining existing operations. No personnel were available for assignment to new projects but documentation and program enhancements were achieved during this period. On-line inquiry was a major improvement to both the Accounting and SIP areas.

It should be noted that during the time period 1972-1976, the Management Services Department (now Data Services) provided a variety of data processing support functions to VCCS. Innumerable reports requiring complicated and detailed analysis were developed. Many of the reports were developed to meet one-time requirements; however, they were necessary to respond to such groups as SCHEV and the Joint Legislative Audit and Review Commission (JLARC). Finally, past data processing efforts can be placed in the proper perspective by noting that in less than five years the VCCS moved from several small independent computers dependent on the postal system as a data transmission medium to a statewide computing network, supporting an RJE batch, an interactive on-line, and TSO networks for twenty-three colleges with centrally developed and maintained software. This accomplishment is significant considering the obstacles which had to be overcome such as limited resources, cumbersome approval processes, and numerous attempts to have the VCCS data processing support subjected to and/or controlled by outside institutions or agencies.

In late 1977, a new Director was hired and given the charge of revitalizing the MIS effort. Since the lack of progress in developmental work was in part due to lack of personnel resources, initial efforts were directed toward amending the 1978-80 budget request to obtain new positions and the associated funding. Of the thirty-nine additional positions identified as required to support an extensive three-to-five year MIS developmental effort, VCCS management approved sixteen for 1977-78 and requested twenty-three for 1978-79. Subsequent budget negotiations resulted in the funding of the sixteen positions for 1977-78 and beyond. These positions were actually established by Personnel/Budget on 4/5/78. The other twenty-three positions were not funded and were not included in the headcount limits. This required a reduction in developmental plans and a concentration of efforts on the highest priority projects. Another problem area was the apparent lack of user

satisfaction with existing systems as well as unfulfilled expectations related to the MIS as projected in the original McManis Study. To address these problems, a multi-discipline MIS Planning Committee was established by the Chancellor in October, 1977 to develop an overall plan for information processing; to review requests for computer, software, and data processing personnel resources; to ensure the involvement of users in the system development process; and to monitor the progress of developmental projects. The Committee established project teams consisting primarily of user management-level personnel assisted by technical project leaders to undertake the highest priority projects:

1. Accounting
2. Personnel/Payroll
3. Student Information
4. Graduate Placement/Transfer
5. Facilities Utilization Analysis

To promote a uniform, professional approach to the system development process, VCCS has acquired a proprietary package called SDM/70. This package contains a comprehensive System Development Methodology that is compatible with MASD's guidelines (for a phased approach to system development) and resource procurement procedures. Each project team utilized SDM/70 to guide its activities and to specify the contents of each phase's product. A complementary project control/tracking package called PC/70 was also acquired and will provide detailed reports on time spent on each activity/task and on project costs and aid in planning.

Data Services has published initial sections of its System Management Guide (SMG). This Guide will serve both users and the Data Services staff by providing standard policies and procedures in support of data processing functions. SDM/70 supports the system development philosophy adopted by the MIS Planning Committee and set forth, in general terms, in the SMG.

On August 16, 1979, the State Board for Community Colleges approved a new management concept for the VCCS. Under the new concept, the VCCS Central Staff was to function in a review and oversight role, thereby delegating maximum authority to the Presidents for the day-to-day management.

In August of 1979, the Director of Data Services resigned and the position remained vacant for approximately seven months. After a comprehensive search to fill the position of Director of Data Services, a new Director was appointed

in January 1980 and assumed office officially on February 1, 1980. The incumbent Director was faced with a formidable task of reorganizing and reducing Data Services personnel by 18 positions, achieving stability, and completing a comprehensive Automated Data Processing master plan for providing computing services in the VCCS

Pursuant to this change in administration and management concept the interim Chancellor appointed a task force to develop an appropriate strategy for the VCCS to support its computing services requirements. This strategy incorporated such items as a MIS Planning Committee and related Project Teams, the "State of the Art" technology, and the new executive management philosophy advocating some decentralization of management in the VCCS.

The task force developed a plan and presented it in December 1979. The Plan was accepted by the interim Chancellor and the Presidents but was not approved by the Division of Management Analysis and System Development (MASD), since it advocated a duplication of development effort and proliferation of developmental personnel in the colleges. It also lacked a specific cost analysis of alternatives, a cost benefit study, and a strategy for implementing the proposed objectives. The mission of the System Offices as opposed to the colleges was also extremently unclear in relation to the new executive management philosophy.

It was clear that there would be very little progress for computing in the VCCS and only minimal computing resources approved until the completion of an acceptable ADP master plan. The new Director of Data Services was, therefore, faced with task of organizing and developing an acceptable master plan and obtaining concensus of VCCS administration, the colleges, and external state agencies.

A new Chancellor of the VCCS assumed office on July 1, 1980, and promptly established preliminary ADP policies governing the provision of computing services in the VCCS. The major impact of these policies relate to the development of a single compatible computing system, non-duplication of effort, and maximum sharing of applications and resources. The Chancellor also made the development of an acceptable Master Plan a top priority. This Plan is a result of the Chancellor's directives and goals.

4.2 KEY RESOURCES

In analyzing the present situation of the VCCS Computing System one must ascertain the key resource areas provided by each of the components in terms of measurable output.

4.2.1 Data Services Key Resource Areas

VCCS Data Services currently has the capability for providing the following key resources:

1. Considerable expertise in systems analysis, programming, and system-wide applications.

2. Management expertise and management tools in the area of establishing and operating a medium-to-large computer processing center.

3. Proximity and peer association with external agencies that recommend or control data processing resources.

4. Centralized System Offices jurisdiction beyond the individual college environment.

The following describe how Data Services is currently utilizing its key resources:

1. Several major applications have been developed, maintained, and/or enhanced centrally. Other scheduled major applications have not been developed centrally due to complexity of applications, lack of developmental personnel, and insufficient or unstable central computing power. Complexity and lack of personnel still exist while central computing power has become much more stable and abundant. Considerable user consulting is available in analysis, design, and programming techniques and standards. Consulting in software languages is generally limited to COBOL applications with some experience in other languages.

2. The Consolidated Computer Facility is managed and operated in a joint venture between VCCS and Virginia Commonwealth University. General stability and considerable computer power have been maintained via the central site (major upgrade in computing power scheduled for December of 1980). Experience in managing and coordinating remote processing centers has been hampered by lack of overall direction, incompatible computer processing centers, and the inability of colleges and the System Offices to agree on common goals. A loose network of computer processing centers and colleges through remote job entry has been obtained, and limited standardization has occurred.

3. Data Services has been somewhat hampered in the past in its coordinating activities with other state agencies that are responsible for recommending or

approving data processing resources. Recently, however, Data Services has begun to build a good rapport and responsible relationship with other state agencies and has been successful in obtaining some required resources. Obtaining resources has been very difficult due to lack of an overall plan and common direction. Once these deficiencies have been overcome, the position of Data Services in the planning and acquisition of resources will be much enhanced and the ability to deliver resources will be considerably improved.

4. Data Services has had to date limited success in fulfilling its management oversight and review functions as these pertain to computer services resources. Duplication does presently occur mainly due to non-compatible processing centers and the lack of overall direction and control. Regarding the future, Data Services staff have every assurance that, based on their perspective of system-wide computing services needs, they will fulfill their oversight and review functions.

The overall ability of Data Services to provide key resources will depend on the presence of a viable overall direction, sufficient personnel in appropriatee level positions, and commitment of interested parties.

4.2.2 College Key Resources

College key resource areas are somewhat similar to Data Services resources areas with some exceptions and deletions. The following are key resource areas in terms of measurable output that are associated with the colleges in the VCCS:

1. Expertise in overall application design requirements in systems that support primarily day-to-day operations and management decision-making within the colleges.

2. Expertise in analysis, design, and programming exists in the colleges in either IBM or Hewlett-Packard systems and software languages.

3. Management expertise exists in the colleges related to small-to- medium-sized processing and development centers.

4. Colleges have proximity to disciplines associated with the teaching of data processing concepts at the local level and direct association with computer sciences departments.

5. The colleges have the latitude to meet ad hoc, individual data processing needs.

In terms of examining the present situation related to these key resources the following circumstances or results have been attained:

1. Several colleges have capabilities for designing, developing and implementing college-oriented user applications software, especially in systems like Student Information and in management systems like the Faculty Productivity Analysis.

2. Several major applications including student registration and related systems have been completed by the colleges either acting independently or in cooperation with other colleges. Expertise does exist in working with either Hewlett-Packard or IBM systems. Expertise in a wide variety of languages and with software packages is generally more prevalent at the colleges than at the System Offices.

3. Five medium-sized Hewlett-Packard, one medium-sized IBM, and several small processing centers currently exist in the colleges demonstrating a key resource in management expertise for small-to-medium-sized processing and development centers.

4. Colleges are generally in a more favorable position in educational computing due to their proximity to students, data processing technology program areas and association with the faculty of an educational institution. College Personnel can participate in more direct training of data processing students and faculty. Additionally, a resource pool of part-time or full-time student staff may be available.

5. Unique and ad hoc institutional computing needs can be best supported by the individual colleges.

The colleges, therefore, also have a wide range of key existing resource areas that must be taken into account for the overall system. See Appendix F for a detail listing of existing resources.

Chapter 5

ASSUMPTIONS RELATED TO THE PROVISION OF COMPUTING SERVICES

5.1 MAJOR ASSUMPTIONS

This Plan is based on the following constraints or assumptions:

1. There is a firm commitment from all levels of VCCS management to the attainment of the established goals.

2. Sufficient staff and resources will be made available for the purpose of realistically achieving the goals.

3. The VCCS will reduce its dependency on the Consolidated Computer Facility and seek to redirect significant amounts of funds and resources committed thru 1982 toward establishing a primary computing resource within the VCCS.

4. The scope of computing services will include support for all mission responsibilities of the VCCS.

5. Data is recognized as a major institutional resource along with fiscal, human, physical and intellectual resources.

6. The requisite configuration will be a distributed computing network which supports personnel, hardware, software and data bases at various sites throughout the VCCS.

7. The distributed computing network system will support the VCCS hierarchy of information requirements.

8. VCCS Data Services will coordinate and monitor all application design, development, and implementation efforts throughout the distributed computing network.

9. Systems development/enhancement efforts will be conducted in accordance with the MASD approved system development methodology and will be supported by full user and technical documentation to meet the needs of the VCCS Data Services Staff and the colleges, the requirements of the Auditor of Public Accounts and MASD.

10. The VCCS Computing Services Planning Committee will assume responsibility for the planning associated with computing services.

11. Requests for new college data processing resources will be reviewed and monitored by VCCS Data Services to determine if each request is within the scope of this Plan.

12. Unit cost of hardware will continue to decrease as capacity and capability increase so that it should be feasible to locate more data bases and processing facilities on-site at the colleges.

13. Unit cost of support personnel will continue to increase and may become the controlling factor in determining the feasibility of expanded hardware or the mode of new distributed computing network implementation.

14. Cost of conventional telecommunications will continue to increase and may affect the implementation mode of certain systems; applications will be tailored around the various college processes.

15. Improvements in communications technology and facilities expected to be widely available in the next two years will allow for a more sophisticated network configuration and promote increased sharing of resources.

16. Overall VCCS computing services must be expandable to accommodate increasing requirements for data by external groups such as SCHEV and other State and Federal agencies.

17. The VCCS Data Element Dictionary containing the VCCS data elements will be maintained by the VCCS Data Services.

Chapter 6

SWOPS - STRENGTHS, WEAKNESSES, OPPORTUNITIES AND PROBLEMS

This chapter of the Plan includes an examination of the VCCS Computing Services System; a general appraisal of the environment in which the system operates; and an evaluation of computing services personnel knowledge, attitudes, skills, and habits as they influence VCCS Computing System activities. Such information is organized under the chapter's subsections of strengths, weaknesses, opportunities, and problems.

6.1 STRENGTHS

1. The System Offices serve as a unifying and coordinating agency which characteristically handles Systemwide functions such as payroll, Federal and State reporting, etc.

2. Colleges have substantial knowledge of their own data processing needs.

3. Substantial computer power exists at the VCCS/VCU Consolidated Computer Center which is available to both System Offices and college users.

4. Independent processing/processors are located at some colleges and are presently operational.

5. College data processing courses, programs and curricula exist that provide considerable learning opportunities for students and computing services staff.

6. On-line and remote job entry networks are already in place.

7. Personnel exist with detailed knowledge of overall requirements of the VCCS computing services needs.

8. Technical expertise in a wide variety of computing application areas is available in the VCCS.

9. Since the VCCS is centrally administrated, it is already operating in a manner conducive to the establishment and coordination of a distributive computing network.

10. Extensive studies of computing services needs and requirements are well documented.

11. VCCS management is highly committed to the establishment of an effective data processing environment.

6.2 WEAKNESSES

It is imperative that VCCS computing resources be subjected to closer VCCS management scrutiny and coordination. Increased and more efficient use of computing resources are necessary to meet information required to support operations, management decision making and reporting, and to fulfill a major role in academic computing. This capability cannot be satisfied in the current mixed environment because of the following inherent weaknesses:

1. Current VCCS computing resources lack appropriate procedures, standards and controls.

2. Most colleges and the System Offices have insufficient computing resources.

3. No general performance criteria exist to evaluate progress or the degree of success in accomplishing computing services objectives.

4. Existing computing services lack compatible operating systems, hardware, and application software.

5. There does not exist an approved comprehensive VCCS Computing Services Master Plan.

6. The current three-pronged management of the Consolidated Computing Center impedes timely, effective planning and the use of computing resources to best serve VCCS needs.

7. Increased costs and a large number of personnel are required to support two large and complex institutions with substantially different missions.

8. Non-communicative processing centers in VCCS network prohibit resource sharing, efficient offloading, and hardware backup.

9. Insufficient staff limits timely maintenance of the existing systems

6.3 OPPORTUNITIES

1. The VCCS is conducive to the sharing of computing resources among the colleges and the System Offices.

2. The VCCS is an ideal environment for a distributed network, shared development, and the promulgation of a fairly unique concept in distributed, shared data processing.

3. The VCCS Data Services staff can provide common direction and standardization throughout the network.

4. There is sufficient flexibility within the VCCS to allow ease of transfer of compatible programs and equipment among colleges and the System Offices.

5. Expertise concerning technical information, user support, network control, and training can be consolidated.

6. A unified computing services network provides the potential for obtaining a larger budgetary base to satisfy VCCS Computing requirements.

7. Unique and ad hoc institutional computing needs can be best supported by individual colleges.

6.4 PROBLEMS

The weaknesses described in section 6.2, have resulted in the following problems:

1. Automated computing applications are not being developed to adequately support the operation and management of the colleges and the System Offices.

2. The diversity of computing services activities and the lack of a single approved strategy for managing

the development and operation of VCCS computing services have impeded VCCS-college attempts to improve services and have caused widespread dissatisfaction among computing services personnel and many users.

3. The current computing environment cannot adequately serve the field of instruction where such support is becoming essential in many academic disciplines.

4. Incompatible hardware among some colleges has necessarily resulted in duplication of application software development.

5. Sharing a large Consolidated Computer Center with an institution which has a different mission than the VCCS has not provided the necessary management flexibility to achieve optimal use of available resources.

6. Central authority vs. independent college autonomy hampers the timely resolution of many computing services problems.

Chapter 7

GOALS OF COMPUTING SERVICES

During the next four years, computing services in the VCCS will:

1. Satisfy data processing requirements for colleges and the System Offices through effective acquisition and use of resources.

2. Support the VCCS mission and the VCCS Executive Management Philosophy through data processing and computational capabilities.

3. Minimize the duplication of resources by encouraging a high degree of compatibility in general systems software, data base/data communications software, interactive and batch retrieval software, and applications/analytic software.

4. Meet external, internal reporting requirements in terms of data accuracy, appropriateness, timeliness and accessibility.

5. Emphasize flexibility in the design of the distributed computing configuration to permit cost effective hardware/software alternatives.

6. Develop applications reflecting the administrative and academic processes of the college rather than the organization of the college and the VCCS System Offices.

7. Provide networking, shared software, network backup and load balancing to the extent such capabilities are cost effective.

8. Encourage information exchange, user input, and promote consensus within the VCCS.

9. Establish a computing environment which reflects state of the art technology and enhances computer literarcy througout the student body, faculty, and staff of the colleges and System Offices.

10. Provide a strong central mechanism for planning, auditing, governing, and coordinating data processing for the VCCS.

Chapter 8

VCCS COMPUTING SERVICES STRATEGY

The VCCS computing services function is responsible for providing a wide range of data processing services to the community colleges and the System Offices. The future expansion of VCCS Computing Services is set forth in this Chapter's subsections: Computing Strategy and Systems Development. The implementation of these two strategies is presented in Chapter 11. See Appendix L for definition of strategies and terms as they apply to the VCCS and this Master Plan.

8.1 COMPUTING STRATEGY

This section sets forth the strategy governing the hardware, system software, and procedures required to support the VCCS computing goals and objectives. The section examines various strategies and recommends a solution. The recommended strategy was judged most favorably against the following criteria:

1. Acceptability - acceptable to college and System Offices users, and the Office of MASD.

2. Timely and Accurate Information - capable of supporting management decision making needs with timely and accurate information at all levels of the VCCS organization.

3. Cost Effective - provides the most computing resources for available dollars.

4. Flexibility - capable of adapting to changing environmental conditions both internal and external to the VCCS.

5. Compatibility - supports plug-to-plug hardware and similar operating systems throughout all computing installations.

6. Reliability - capable of providing a greater consistency of operations over what is being experienced today.

7. Simplicity - easy to use, maintain, operate, manage and control.

8. Application Deliverability - provide a new interactive Student Information System in 1981.

9. Non-Duplication - capability for producing optimal use of resources.

10. State of the Art Computing - reflects current technology.

11. Management and Control - optimizes the use of data processing resources.

12. Use of Existing Computing Resources - considers the use of existing hardware and software resources.

13. Minimum Staff Requirements - can be implemented, maintained and operated with limited personnel.

8.1.1 Strategies Examined

The following three computing strategies were considered:

1. Centralized

System Offices - Large central host.

Colleges - Local remote job entry (RJE), program development , and data base management system (IMS) capability obtained through a mix of intelligent and

non-intelligent terminals at all colleges.

2. Distributed

System Offices - Moderate central host.

Colleges - Local intelligent, compatible computers of varying sizes strategically placed at certain colleges which support other colleges through computing cooperatives.

3. Decentralized

System Offices - Maintain present level of computing support through a moderate to large central host.

Colleges - Expand existing Hewlett-Packard and IBM equipment to all colleges, depending on college preference.

8.1.2 Analysis of Computing Strategies

The three strategies were examined to determine the degree to which they complied with the thirteen criteria listed in section 8.1. Table 8.1.2, VCCS Computing Strategies Examined, is a matrix which displays, in summary form, how each strategy meets each criterion.

TABLE 8.1.2

VCCS COMPUTING STRATEGIES EXAMINED

Criteria	(1) Centralized	(2) Distributed	(3) Decentralized
1. Acceptability	Yes - System Offices and MASD No - colleges	Yes - System Offices, Colleges, and MASD	Yes - some colleges No - System Offices and MASD
2. Timely & Accurate Information	No - not timely	Yes - timely	No - not timely at all levels - problems with uniformity of data
3. Cost Effective	Yes - in hardware and software No - in communications and transmission of data - more computing power needed to support larger operating system overhead - higher costs associated with backup and redundancy - more complicated incremental expansion steps - has great potential for not satisfying computing requirements of college users	Yes - lower communications costs - lower costs for expansion - lower backup costs - less computing power needed to support operating system overhead No - because of hardware, software and storage duplication	Yes - lower communication costs - less computing power needed to support operating systems overhead No - because of hardware, software and storage duplication
4. Flexibility	No - more complicated incremental expansion steps - restricted and slower access to centralized files	Yes - less complicated incremental expansion steps - faster and easier accessibility to local files	Yes - less complicated incremental expansion steps - faster and easier accessibility to local files
5. Reliability	No - all users vulnerable to interruption due to total system failure	Yes - higher reliability for dispersed computer equipment	Yes - current relative stability of hardware/software
6. Simplicity	No - larger hardware configuration - greater overhead - more sophisticated operating systems	Yes - less complex hardware configurations - less overhead - less sophisticated operating systems - easier access to data	Yes - less complex hardware configurations - less overhead - less sophisticated operating systems - easier access to data

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TABLE 8.1.2 (Continued)

VCCS COMPUTING STRATEGIES EXAMINED

7.	Compatibility	Yes - in hardware and operating systems	Yes - if design of computing network ensures plug-to-plug compatibility of hardware - potential for limiting multi-vendor computing environments	No - hardware and operating will vary depending on number of vendors involved
8.	Application Deliverability	No - too complex to implement - too demanding in resource consumption	Yes - strong potential for meeting computing requirements of most end users - strong potential for providing appropriate computing environments to convert existing Student Information Systems	Yes - Student Information System software already exists in this computing environment and can be readily expanded No - potential for not satisfying computing requirements at t all levels, especially System Offices
9.	Duplication	Yes - no duplication	Yes - has great potential for minimizing duplication in applications software No - duplication in hardware and operating systems	No - duplication in hardware operating systems - great potential for duplicating application software
10.	State-of-the-Art Computing	No - current technology trend not toward large central centers	Yes - reflects current technology trend	No - does not take full advantage of current technology to support a multi-level dispersed VCCS organization
11.	Management and Control	Yes - one computing center promotes greater management and control over computing activities	Yes - if properly organized and configured, optimum management and control over computing activities can be achieved	No - less management and control capability over VCCS computing activities
12.	Use of existing computing resources	No - does not make use of existing resources of some colleges	Yes - regardless of which distributed alternative selected, some existing resources salvageable	Yes - continued use of all existing resources
13.	Minimum Staff Requirements	No - requires large, highly sophisticated staff	Yes - minimum trained staff necessary to operate centers	Yes - minimum trained staff necessary to operate centers

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8.1.3 Recommended Computing Strategy

An analysis of the information on Table 8.1.2 led to the selection of the distributed processing strategy, Strategy No. 2, as the model for delivering computing services in the VCCS. The reasons for selecting this model are as follows:

1. Distributed processing supports the prevailing VCCS management philosophy and policies established for computing services.

2. Distributed processing is widely accepted by the colleges, the System Offices, and MASD.

3. Distributed processing will substantially improve the reliability and availability of computing resources over what is currently provided.

4. Distributed processing will allow a network to be developed which is sufficiently flexible to accomodate future changes and take advantage of improvements in hardware, software, and communications techniques.

5. Distributed processing provides for the proper mix of central versus local management and control to ensure interchangeability and compatibility of data and programs.

6. Distributed processing will provide more alternatives for providing additional computing support without frequent and costly hardware and software upgrades.

8.1.4 Validation of Distributed Computing Strategy

Once the distributed computing strategy was selected, it was then necessary to determine the feasibility of implementing this strategy. A specific planning methodology was employed to validate the need and appropriateness of distributed computing. This methodology involved the following steps:

1. Identify functions, processes, and activities currently supported at the System Offices and colleges.

2. Identify the major classes of data required to support each process or activity.

3. Identify where the data are currently created, used and stored.

4. Define possible computing location groups which could best support each process or activity as follows:

   State - Computing support at the State level.

   Central - Computing support at the System level.

   Regional - Computing support for specific geographical locations within the System.

   College - Computing support at the college level.

   Campus - Computing support at the campus level.

5. Categorize the processes and supporting data classes by computing location groups.

6. Determine Qualitative and Service Level Requirements (Q&SL) with appropriate weights.

7. Assign Q&SL Requirements to each process and data class.

8. Revise categories established in step no. 5 based on the implications of the Q&SL Requirements.

9. Develop the VCCS Computing Distribution Matrix.

10. Develop supporting alternatives and strategies.

11. Develop the preliminary network configuration.

12. Develop the final network configuration.

As a result of completing this process which is detailed in Appendix I, along with the goals specified in Chapter 7, the following two conclusions were derived:

1. Distributed computing was indeed the best strategy to support the VCCS hierarchy of information needs.

2. The distributed computing network should provide for computing support at four levels of the VCCS organizational structure, namely, level one - central host, level two - regional host, level three - college host and level four - college/campus remote.

8.1.5 Distributed Computing Alternatives

Three alternatives were considered to implement the distributed computing strategy:

Alternative 1 - IBM compatible computer hardware at all computing locations throughout the network.

Alternative 2 - IBM compatible computer hardware at the system and regional computing locations; Hewlett-Packard computer hardware at college and campus computing locations.

Alternative 3 - IBM compatible computer hardware at the system and regional computing locations; Hewlett-Packard and IBM computer hardware at college and campus computing locations.

These three alternatives were evaluated using the criteria in Table 8.1.5 and stated as follows:

1. Shareability - hardware to be totally compatible to support program development and execution throughout the distributed network;

2. Essential Network Features - mandatories to meet existing system capabilities and anticipated new requirements. These are detailed in Appendix C.

3. Maximum Network Flexibility - ability to size and interchange computers.

4. General Purpose Computing Capability - capable of executing a wide variety of software for both academic and administrative computing requirements.

5. Unified Training and Education Requirements - similar training and education needs for all computing installations.

6. Ease of Data Element Dictionary Control - ability to maintain commonability of data element definition and structure throughout the distributed network

7. Cost Benefit - meets or exceeds the above criteria 1-6 in the most cost effective manner.

TABLE 8.1.5

MATRIX SHOWING VCCS DISTRIBUTION

ALTERNATIVE CONSIDERED

Criteria	Alternative 1 IBM Compatible All Levels	Alternative 2 IBM Compatible At Levels 1 & 2 H-P At Levels 3 & 4	Alternative 3 IBM Compatible At Levels 1 & 2 IBM & H-P At Levels 3 & 4
1) Maximum Shareability	Yes	No	No
2) Essential Network Features	Yes	No	No
3) Maximum Network Flexibility	Yes	No	No
4) General Purpose Computing Capability	Yes	Yes	Yes
5) Unified Training and Education Requirements	Yes	No	No
6) Ease of Data Element Dictionary Control	Yes	No	No
7) Cost Benefit	Yes	No	No

8.1.6 Recommended Distributed Computing Alternatives

Of the three alternatives considered, the IBM compatible solution, Alternative 1, appears most suitable for implementing the proposed VCCS distributed processing network as shown in Table 8.1.5. In addition, this solution seems most suitable for the VCCS for the following reasons:

1. Provides for general purpose computing hardware with the broadest range of real time and batch administrative and academic applications.

2. Provides the most flexibility for sizing and will support the computing requirements at all four levels of the VCCS distributed network.

3. Provides for maximum integration of administrative applications.

4. Allows the VCCS to capitalize on the extremely varied and diversified amount of available canned software for both administrative and academic requirements.

5. Allows the VCCS to capitalize on third-party competition, thus increasing the opportunity for cost savings.

6. Provides for increased computing capability beyond the other alternatives at relatively the same cost.

7. Creates the potential for improved management coordination, control and acquisition of computing resources throughout the VCCS.

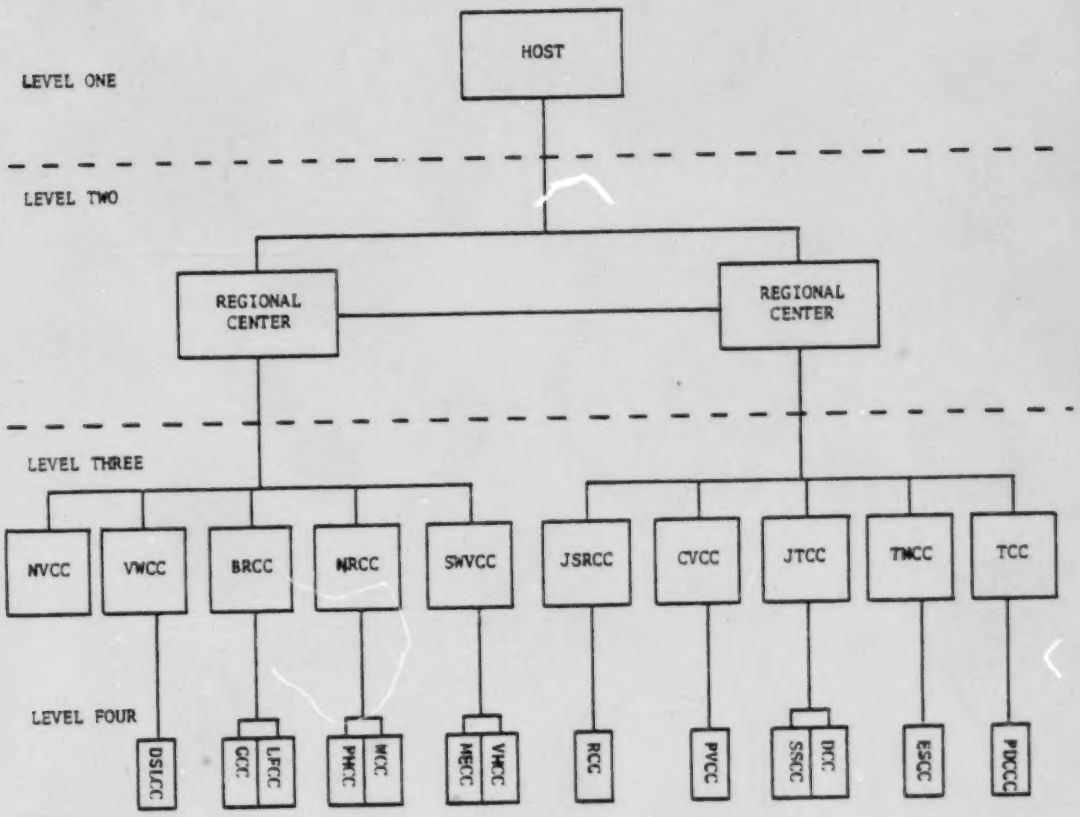
8.1.7 Four Level Network Characteristics

The VCCS will adopt a distributed computing network consisting of IBM compatible computer hardware serving multiple computing locations. The exact number of centers, their size and location will depend heavily on the results of simulating the network and the projected processing workload. Other major considerations include maximum utilization of existing personnel and facilities, geographical proximity, enrollment equalization, technology, local requirements and maximum cost benefits.

For discussion and cost analysis purposes, a four level distributed network model is displayed in Figure 8.1.7. While this model represents the hierarchial computing structure of the VCCS, it is important to emphasize that it does not prescribe how the final network will be configured. Chapter 9 addresses how this final network will be developed.

VCCS DISTRIBUTED PROCESSING NETWORK: A CONCEPTUAL MODEL

FIGURE 8.1.7



RELATIVE SIZES

LEVEL ONE	CENTRAL HOST	370/158 EQUIVALENT
LEVEL TWO	REGIONAL HOST	370/148 EQUIVALENT
LEVEL THREE	COLLEGE CENTER	370/138 EQUIVALENT
LEVEL FOUR	COLLEGE/CAMPUS	3776/77 EQUIVALENT

NOTE: It is important to emphasize that size and number of computing installations and their location are subject to change in the final network configuration.

The four level distributed network within the VCCS is characterized as follows:

1. Four level network approach

a) Level One - Central Host - (Presently the VCCS/VCU Consolidated Computer Facility) This could be either maintained at the Consolidated Center or moved to the VCCS Test and Services Center, according to the most efficient delivery of resources.

The central host processor is a general purpose computer system capable of handling large complex data base and data communications applications. The host is also particularly well suited to the processing of large volumes of "batch" type programs including fast batch compiles for students use. The major functions assigned to the central host are to provide centralized management and control of the network and computing support for the existing applications as well as the new ones to be supported at this level. The host will be connected to the regional centers via communication lines to allow the sharing of data and programs, diagnostics, maintenance, monitoring and controls.

b) Level Two Regional Host

The regional host processors are general purpose computer systems of a similar class. The regional hosts are designed to support interactive administrative and academic processing. Support functions include selection, monitoring, maintenance and generalization of operating systems, subsystems, and Data Base/Data Communications systems necessary for the operation of all college host processors. These processors will also support the systems development activities for system-wide development and ad hoc college requirements.

c) Level Three College Cooperative Host

The college host processors will be used as dedicated interactive application processors (primarily Student Information Systems and associated systems). They will be located at selected colleges serving at least one additional college in close proximity to minimize communications costs and maximize the

responsiveness to the end user. Batch processing would primarily be jobs that are necessary to recover, forward, maintain and print data collected by the on-line applications.

d) Level Four College/Campus Remote

The college/campus remotes are non-intelligent RJE stations and CRT's capable of supporting the following:

Data entry in a "pass through" mode to a higher level processor.

Data entry in a "store and forward" mode for processing later on a higher level processor.

Inquiry/update of a higher level processor's data base.

Remote job entry to a higher level processor.

Text editing of source programs and other data such as job control language (JCL).

Terminals and CRT's located at this level will have complete access to all levels of the network.

2. Local autonomy of data processing operations.

3. Distributed data bases at the appropriate level.

4. Administrative or academic computing available at levels one, two and three.

5. Utilization of intelligent, multi-purpose, compatible (at the source code level) processors at levels one, two and three.

6. Possible utilization of various intelligent and non-intelligent terminals at level four.

The proposed network configuration (see Figure 8.1.7) will consist of one central host, two or more regional centers, 10 college cooperative centers and 24 college/campus remotes. The flexible design of the network supports increases or decreases in the number of centers at each level and the movement of centers from one level to another if necessary. One major objective in designing the final

network is to provide adequate computing facilities to manage the present workload and the anticipated future increases without developing large complex computing centers. In addition, costly and frequent hardware upgrades can be avoided by offloading and maximizing the use of all centers.

The establishment of a distributed computing network as outlined above will serve to ensure transportability of applications and an adequate level of computing support for all VCCS users.

8.2 SYSTEMS DEVELOPMENT STRATEGY

A strategy is necessary for developing, enhancing, maintaining, and acquiring application and system software according to established policies. This section examines three strategies and recommends a solution for addressing existing and future administrative and academic systems requirements. Current college and System Offices systems development efforts and mandatory requirements were considered in recommending the overall strategy to ensure the most cost effective alternative.

Centralized development, shared development and decentralized development strategies were judged against the following criteria as shown in Table 8.2.

1. Acceptability - acceptable to college and System Offices users and the Office of MASD.

2. Non-Duplication - minimizes the duplication of System Development.

3. Management and Control - optimizes the use of data processing resources, especially development personnel.

4. Application Deliverability - provides the capability for implementing a new interactive student information system in 1981.

5. Use of Existing Applications - considers the use of existing software.

6. Flexibility - capable of adapting to changing environmental conditions both internal and external to the VCCS.

7. Conformity - achieves system-wide standardization in definition and reporting of data.

8. Quality - improves significantly the usefulness of user oriented applications.

9. Ad Hoc Reporting - ability to provide timely information in response to unique needs of users in any level of the VCCS organization.

10. User Participation - provides potential for increased user involvement.

11. Optimal Personnel Usage - provides for most efficient utilization of personnel in the colleges and Systems Offices.

12. Sensitivity - increases potential for systems development process to be sensitive to VCCS hierarchy of information needs.

13. Cost Benefit - meets or exceeds the above criteria in the most cost effective manner

TABLE 8.2

THREE VCCS SYSTEM DEVELOPMENT STRATEGIES EXAMINED

CRITERIA	(1) CENTRALIZED	(2) SHARED	(3) DECENTRALIZED
1. Acceptability	Yes-System Offices and MASD No-Colleges	Yes-System Offices, Colleges and MASD	Yes-Some Colleges No-System Offices and MASD
2. Duplication	Yes-duplication of developmental efforts eliminated	Yes-duplication of developmental effort discouraged	No-Increased potential for duplication of systems development efforts and functions
3. Management and Control	Yes-potential for maximum control	Yes-potential for adaquate control if appropriate management structure is established which includes System Offices auditing function	No-most difficult to control because various systems development efforts are autonomous
4. Application Deliverability	No-centralized resources not available -tremendous college resistance because historically ineffective and low productivity	Yes-maximizes use of resources throughout VCCS organization -past experiences successful -optimal utilization of expertise where it exists	Yes-senitive to college needs but not system-wide needs No-does not optimize utilization of resources throughout VCCS organization
5. Use of Existing Applications	No-no interactive VCCS applications exist -existing interactive college applications would have to be converted	No-all existing interactive college applications would have to be converted	Yes-VCCS applications, H-P applications and NVCC IBM applications are all usable in their unique invironments
6. Flexibility	No-highly unlikely for applications to reflect changing needs in timely manner	Yes-potential exists for flexibility assuming appropriate management structure is established whereby commonality exists in data elements and data reporting	Yes-at individual college where computing resources exists No-difficult to respond to system-wide needs

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TABLE 8.2 (Continued)

THREE VCCS SYSTEM DEVELOPMENT STRATEGIES EXAMINED

7. Conformity	Yes-great similarity in data element definitions and the reporting of data	Yes-if appropriate management structure is established whereby commonality exists for data elements and data reporting	No-difficult to standardize
8. Quality	No-user-oriented applications highly unlikely	Yes-user-oriented applications highly likely because systems development staff are logistically close to functions the systems are designed to serve	Yes-limited to colleges with computing resources No-would not satisfy system-wide needs
9. Ad Hoc Reporting	No-not inclined to be responsive to users at all levels of VCCS organization	Yes-potential will exist for users at any level of the VCCS organization to fulfill specific information needs in a timely manner	Yes-limited to colleges with computing resources No-would not satisfy system-wide needs
10. User Participation	No-difficult to achieve maximum input	Yes-potential exists because development will take place where functions to be supported reside	Yes-limited to colleges with computing resources No-system-wide applications may not benefit from adequate user input
11. Optimal Personnel Usage	No-insufficient use of college personnel	Yes-maximum use of personnel throughout the VCCS organization -creates potential for minimizing duplication effort	No-definite duplication of personnel effort
12. Sensitivity	No-insensitive to specific needs of functional users due to geographic proximity	Yes-increased potential for application development process to meet the VCCS hierarchy of information needs	Yes-sensitive to college information needs No-unsensitive to information needs of System Offices
13. Cost Benefit	No-cannot meet above criteria	Yes-meets above criteria	No-cannot meet above criteria

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8.2.1 Recommended Systems Development Strategy

An analysis of the responses to each criterion as shown in Table 8.2 led to the selection of shared development, Strategy No. 2, as the most appropriate strategy for conducting systems development activities within the VCCS. This solution appears most suitable for the VCCS for the following reasons:

1. Shared development is the most effective and efficient approach for utilizing existing system development staff;

2. Shared development produces an environment in which college and Systems Offices staff work cooperatively on systems development projects serving mutual needs;

3. Shared development provides the VCCS with the capability for prioritizing and then carrying out several systems development projects concurrently, thereby making the most effective and efficient use of personnel resources.

4. Shared development is consistent with the VCCS management philosophy in that it balances responsibilities between the System Offices and the colleges;

5. Shared development is conducive to end-user involvement in systems development activities, thereby minimizing end-user dissatisfaction.

8.2.2 Validation of Systems Development Strategy

The validation of shared systems development rests on VCCS experience. Shared development has proved to be a successful approach in the VCCS in the recent past. Examples include the Hewlett-Packard Colleges effort - five colleges working collectively to develop a student information system for use on Hewlett-Packard equipment; the PAS effort - one college designed and developed a management tool which has been implemented in the 23 colleges and the Systems Offices; the Northern Virginia effort - one college designed and developed a student information system and associated systems which were implemented at its five campuses.

8.3 SUMMARY

In summary, this chapter has established that the VCCS computing services function will be characterized by shared systems development in a distributed IBM - compatible environment. These strategies will form the basis for planning future computing services in the VCCS.

Chapter 9

ORGANIZATIONAL AND PERSONNEL REQUIREMENTS

9.1 SCOPE

This chapter covers existing and planned data processing personnel required at the System Offices and colleges to implement and support the strategies set forth in this plan. Additional system-wide development personnel for the System Offices and the colleges will not be addressed in this chapter. Additional data processing positions to provide support beyond what is described in this plan must be justified by a local plan. The following categories of personnel will be covered in this chapter:

1. Management
2. Systems Development (Existing)
3. Technical Support
4. Operations Support
5. User Services
6. Clerical Support

9.2 PROPOSED FUNCTIONS

An organizational structure is the logical grouping of functions and people who provide them. Before an activity can be organized, it is essential that its functions be defined and fully understood. The principal data processing functions proposed for the System Offices and Colleges are as follows:

SYSTEM OFFICES

1. MANAGEMENT AND ADMINISTRATION - Provide for the overall planning, security, coordination, project management, and administrative reporting for the VCCS Computing Services System, including colleges and central host activities.

2. SYSTEMS DEVELOPMENT - Provide for the development, enhancement, and maintenance of System Offices and system-wide administrative applications. Coordinate the systems development activities of the colleges supporting academic computing, local administrative development, and shared system-wide development.

3. TECHNICAL SUPPORT - Provide for standards and procedures, systems programming, data base administration, teleprocessing support, system evaluation and configuration, and technical assistance.

4. OPERATIONS SUPPORT - Provide for the development and operation of the Test and Services center (Regional), the distributed computing network, and coordination of the central host.

5. USER SERVICES - Provide for standards and procedures, user consulting, training, planning, academic computing support, systems development methodology, quality assurance, a technical library, a tape/disk library and general software implementation.

6. CLERICAL SUPPORT - Provide clerical and secretarial activities necessary to support the functions and responsibilities of Data Services.

COLLEGES

1. MANAGEMENT AND ADMINISTRATION - Provide for local planning, security, coordination, and administrative reporting at regional and college centers.

2. SYSTEMS DEVELOPMENT - Assist in the development, enhancement, and maintenance of system-wide

administrative applications. Conduct the systems development activities associated with academic computing and special local requirements.

3. OPERATIONS SUPPORT - Provide for the operation and maintenance of the local centers.

4. USER SERVICES - Assist in training and user support.

9.3 EXISTING POSITIONS

Figure 9.1 depicts Data Services' staff which total: 3 management, 2 Project Managers, 8 analyst, 4 programmers, 2 technical support, 5 operations support and 2 clerical support.

Figure 9.2 sets forth the Consolidated Computer Facility's organization which includes: 3 management, 3 programmers, 6 technical support, 13 operations support and 2 clerical support.

Figure 9.3 traces the history of staff at Data Services.

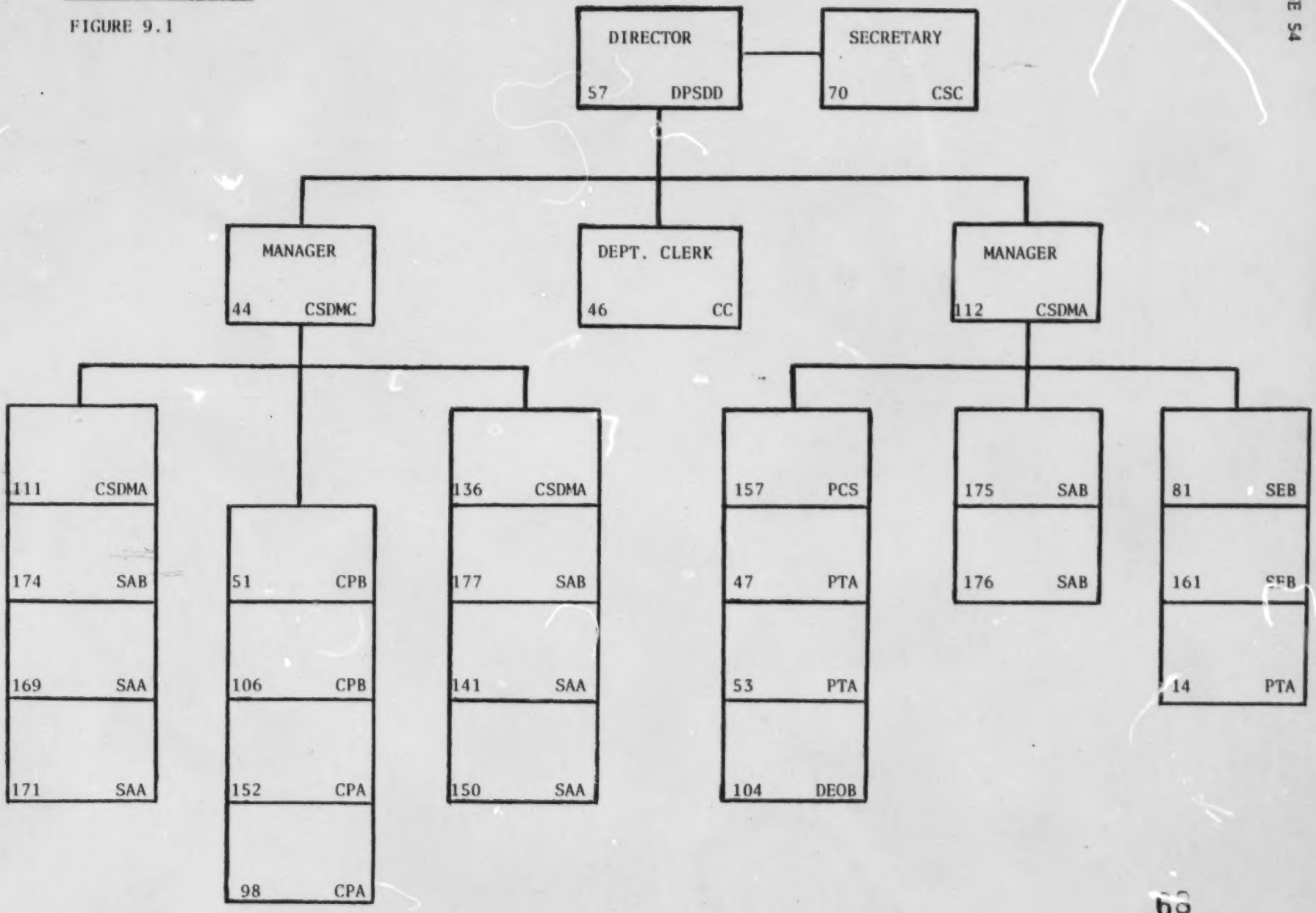
See Appendix F.2 for a breakdown of the colleges fulltime classified data processing resources which total: 1 management, 7 analysts, 19 programmers, 67 operations support, and 9 clerical support.

NOTE: A number of colleges also utilize administrative faculty and temporary positions (P14) to support their data processing operations.

The following briefly describes the proposed functions for existing personnel.

VCCS DATA SERVICES

FIGURE 9.1



CONSOLIDATED COMPUTER FACILITY

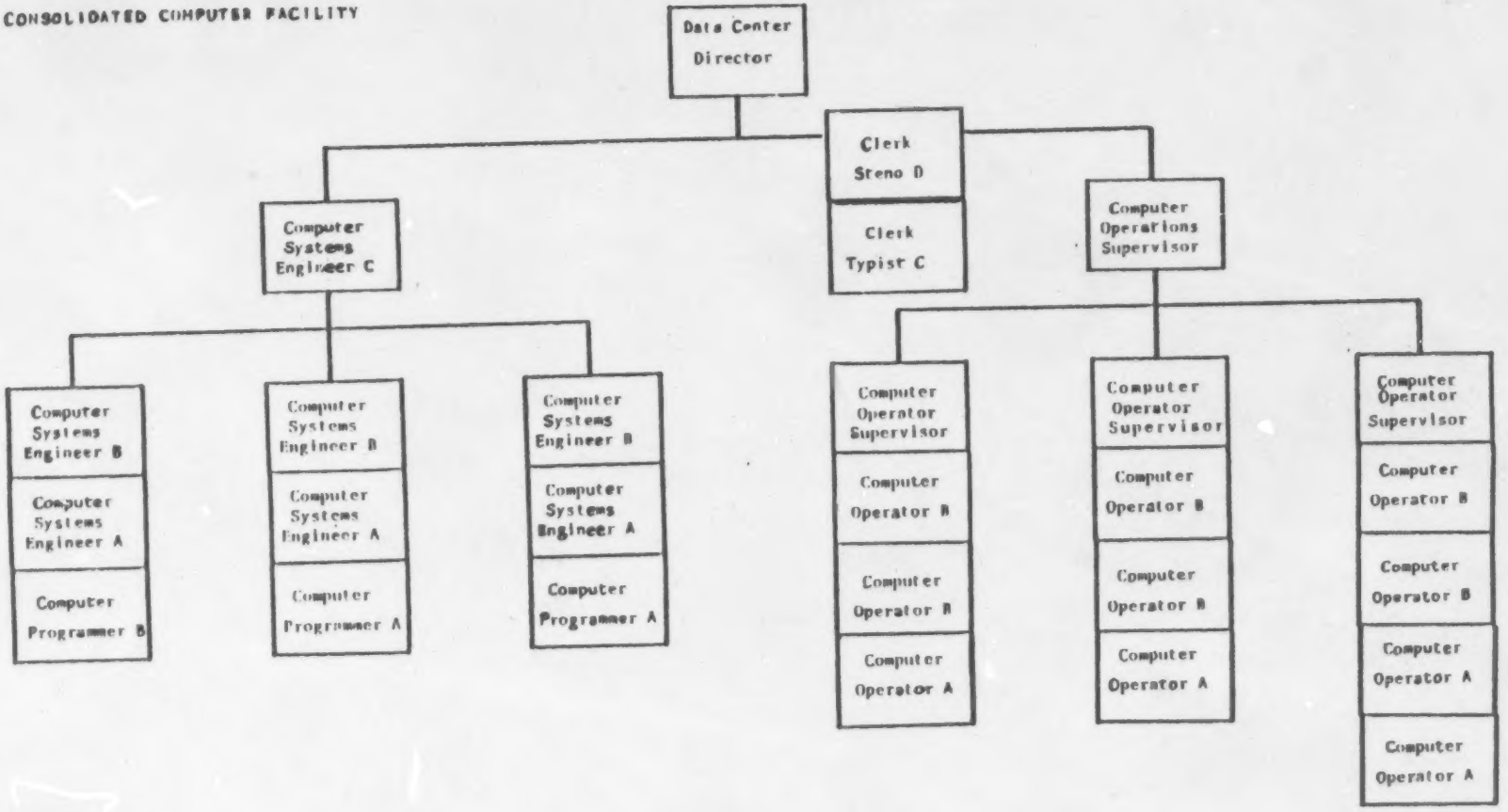


FIGURE 9.2

POSITION TITLE	1967	1968	1969	1970	1972	1973	1974	1975	1977	1978	1979	1980
VCCS DATA PROCESSING DIRECTOR	1	1	1	1	1	1	1	1	1	1	1	1
SYSTEMS DEVELOPMENT MGR. C	1	1	1	1	1	1	1	1	1	1	1	1
SYSTEMS DEVELOPMENT MGR. B									1			
SYSTEMS DEVELOPMENT MGR. A				1	1	1	1	1		3	3	3
SYSTEMS ENGINEER B		1	1	1	1	1	1	1	1	1	1	1
SYSTEMS ENGINEER A	1	1	1	1	1	1	1	1		3	1	1
SYSTEMS ANALYST B							2	2	2	5	4	4
SYSTEMS ANALYST A						1	2	2	2	4	4	4
PROGRAMMER B	1	2	3	3	3	3	4	4	5	7	2	2
PROGRAMMER A								1	2	4	2	2
PROGRAMMER TRAINEE			1	1	1	1	2	2	1	2		
PRODUCTION CONTROL SUPERVISOR								1		1	1	1
PRODUCTION TECHNICIAN B									1			
PRODUCTION TECHNICIAN A	1	1	1	1	1	1	2	3	1	3	3	3
PRODUCTION TECHNICIAN TRAINEE						1	1	1		1		
COMPUTER OPERATOR B									2			
DATA ENTRY OPERATOR B		1	1	1	1	1	1	1	1	1	1	1
DATA ENTRY OPERATOR A					1	1	1	2	3	3		
CLERK STENO D									1			
CLERK STENO C	1	1	1	1	1	1	1	1	1	1	1	1
CLERK TYPIST C		1	1	1	1	1	1	1	1	1	1	1
CLERK C	1	1	1	1	1	1	1	1		1		
TOTAL	7	11	13	14	15	17	23	27	27	43	26	26

FIGURE 9.3 Data Services Staff History

EXISTING SYSTEM OFFICES POSITIONS

1. MANAGEMENT AND ADMINISTRATION

   a) 1 Director - plans and directs all computing services activities for the System Offices and provides coordination, management oversight, and audit review for all college data processing activities, including the central host functions.

   b) 1 Manager Systems Development and User Services - directs all systems development and user support functions and activities for the System Offices and coordinates all system-wide development. Provides management recommendations for central host activities.

   c) 1 Manager Operations and Technical Support - directs all operations, technical support and production control for the System Offices, and overall network operations for the colleges and the central host activities.

2. SYSTEMS DEVELOPMENT (Maintenance/Enhancements)

   a) 2 Project Managers - Responsible for detail planning, organizing, directing, coordinating, controlling, measuring, reporting and evaluating maintenance and enhancements in the existing project areas.

   b) 6 Systems Analysts (Maintenance) - Gathers and analyzes information for modifying applications software.

   c) 4 Computer Programmers (Maintenance) - Designs and tests program logic, codes, programs, documents and prepares programs for operation.

3. TECHNICAL SUPPORT

   a) 2 Systems Programmers - Installs and maintains existing system software at the VCCF to include IMS DB/DC, JDS, ADF, etc.

4. OPERATIONS SUPPORT

a) 1 Production Control Supervisor - Supervises the receipt, checking, control, and output quality of work flowing through the production shop.

b) 1 Production Technician - Prepares, schedules, submits, and maintians production job streams and the associated documentation.

c) 1 Data Entry Operator - Converts data on source documents into machine acceptable form.

d) 1 Network Operator - Maintains operational control in the current Data Base/Data Communication System installed at the VCCF.

e) 1 Tape/Disk Librarian - Maintains tape and disk resources.

5. USER SERVICES

a) 2 User Services Coordinators (System Analysts) - Provides package support, user consulting, technical writing and coordinates academic computing.

6. CLERICAL SUPPORT

a) 2 Clerical - Supports secreterial and clerical activities required by Data Services.

EXISTING COLLEGE POSITIONS

Actual placement of computing centers will depend on present staffing levels at the colleges. These staff will continue to support existing computing services activities. Once the new computing environment is established, these personnel resources will become extensively involved in shared systems development activites and/or operational support of the distributed network.

VIRGINIA CONSOLIDATED COMPUTER FACILITY

As the requirement for computing support is diminished at the VCCF, monies for positions at the VCCF currently funded by the VCCS will be reduced and savings will be used to support positions for the VCCS Computing Services System.

9.4 PROPOSED ADDITIONAL POSITIONS

The purpose of this section is to summarize the proposed additional number and types of classified data processing positions (and possibly some administrative faculty positions for the management and administrative role) required to implement the strategies outlined in this plan. This does not preclude the need for additional staffing to support needs or requirements not addressed by this plan.

1. MANAGEMENT AND ADMINISTRATION

   No additional new positions proposed but an upgrade of existing positions will be required due to increased coordination and management oversight functions.

2. SYSTEM DEVELOPMENT

   a) 1 Project Manager - Responsible for detail planning, organizing, directing, coordinating, controlling, measuring, reporting and evaluating shared development.

   b) 1 Project Controller/Quality Assurance - Establishes and administers a project planning, control and reporting system. Evaluates project products against standards and procedures to ensure compliance.

   c) 1 Data Base Manager - Designs and maintains the integrity of VCCS Data Bases. Prepares and enforces standards for use and security of information in the data bases.

   d) 1 Data Base Analyst - Translates requirements defined by the data administrator into logical, economical, and practical data base designs.

SYSTEM DEVELOPMENT (Application Analysts and Programmers)

As state-wide administrative application development gets underway, an assessment will be made on what can be reasonably expected from current personnel resources. Needs beyond the the projected accomplishments of existing personnel will be satsified in one or more of the following ways:

a) The enlistment of part-time system development personnel.

b) The purchase of contractual services.

c) The purchase of canned software packages.

d) Increasing the number of permanent systems development personnel in the colleges and/or System Offices.

3. TECHNICAL SUPPORT

a) 1 Technical Support Supervisor - Directs the system programming activities, network control and maintenance.

b) 2 System Engineers - Installs and maintains system software at levels 2 and 3 of the proposed network. Software includes operating systems, DBMS, etc.

c) 2 Computer Center Opertions Specialist - Serves as Senior Technical Shift Specialist and Network Operator.

d) 2 Senior Programmer/Analyst - Assist engineers in problem determination and the installation and maintenance of system software at levels 1, 2 and 3.

4. OPERATIONS SUPPORT

Level 1 - Central Host[1] (Presently supported by existing positions assigned to the Consolidated Computer Facility)

a) 1 Operations Supervisor - Supervises the personnel responsible for equipment operation.

b) 3 Senior Operators - initializes the operating system, operates the computer, monitors system performance by means of a console and, in some cases, online terminals.

c) 3 Junior Operators - assists the console operator in computer system operation by setting up and operating peripheral equipment.

Level 2 - Regional Center (Service and Test)

a) 1 Senior Operator - Initializes the operating system, operates the computer, monitors system performance by means of console and, in some cases, online terminals.

b) 2 Junior Operators - Assists the console operator in computer system operation. Monitors work flow through regional center for output quality and control.

Level 2 - Regional Center (2 Locations)

a) 2 Senior Operator - Initializes the operating system, operates the computer, monitors system performance by means of console and, in some cases, online terminals.

b) 4 Junior Operators - Assists the console operator in computer system operation. Monitors work flow through regional center for output quality and control.

---

[1] These positions are not included in the summary (section 9.5) since they already exist.

Level 3 - College Cooperative Host (10 Locations)[1]

a) 1 Junior Operator (per-shift) at each of ten centers - Assists center coordinators and operates computer equipment. Will be supported by existing personnel with some possible reallocations.

5. USER SERVICES

a) 1 User Services Supervisor - Supervises the personnel responsible for providing user support.

b) 1 Technical Librarian - Maintains a library of system documentations programs source listing, reviews submitted documentation for standards and distributes to authorized holders.

c) 1 Systems Analyst - Assist in user training and application support.

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[1] These positions are not included in the summary (section 9.5) since they already exist.

9.5 SUMMARY

	EXISTING POSITIONS COLLEGES	EXISTING POSITIONS SYSTEM OFFICES	ADDITIONAL* POSITIONS	TOTAL
FUNCTIONS				
Management and Admin	10	3	0	13
Systems Development	25	12	4	41
Technical Support	0	2	7	9
Operations Support	65	5	9	79
User Services	0	2	3	5
Clerical Support	9	2	0	11
	109	26	23	158

New personnel requirements within the colleges will be phased in as the level 2 & 3 centers are established. A reassessment of current classifications and levels of existing positions will be necessary as appropriate.

Personnel requirements within the colleges will be obtained through the reclassification of existing data processing positions and the reallocation/reclassification of non-data processing positions. All position requirements must be within the established guidelines of the colleges. Personnel resources for special non-system-wide college development needs will be the responsibility of the colleges.

Every reasonable effort will be made to limit the need for additional positions beyond what has been identified for support of this Plan. However, it may be necessary to request additional positions to support new or expanded services. These request will be handled on a project by project basis.

* The twenty three additional positions do not necessarily reflect new positions, but possible reallocation of existing positions within established targets.

Chapter 10

FINANCIAL REQUIREMENTS

10.1 OVERVIEW

The cost analysis of the proposed distributed computing alternatives resulted from a three-step effort. In the first step, a detailed inventory of existing hardware (See Appendix F.1), software (See Appendix F), personnel (See Appendix F.2), and maintenance costs was prepared, and the current costs of computing in the VCCS were determined (See Figure 10.3).

During the second step, vendor supplied configurations were applied to the proposed distributed computing alternatives. In order for the vendors to construct and cost their configurations, a basic four level distributed computing model was developed and supplied to each vendor. This model as shown in Figure 8.1.7, was developed for planning purposes only and is not intended to describe precisely the size and number of computers, nodes and their locations. The cost of these configurations for each of the three alternatives was established, and only small cost differences were revealed as indicated in Table 10.1 which is a cost analysis of the proposed model by levels and distributed alternatives. It should be noted that costs were determined using vendor supplied estimates. Costs will, therefore, likely change when more competitive prices are obtained through a formal Request for Proposal process. Also, a substantial cost reduction, approximately $450,000., should occur during the implementation of the Plan due to displacement of existing hardware and software.

An analysis was also made of existing software developed in the Student Information System (See Appendix H). The analysis indicated that substantial funds had been expended in the development of duplicate software in this area but that there was no radical difference in costs invested in the two efforts.

TABLE 10.1

COST ANALYSIS SUMMARY BY LEVELS

LEVEL 1	Alternative 1	Alternative 2	Alternative 3
Monthly Hdwre Cost (If Purchase - 3 yr)	$ 19,315.	$ 19,315.	$ 19,315.
Monthly Maintenance (If Purchase)	2,530.	2.530.	2,530.
Monthly Hardware - (If Lease)	17,033.	17,033.	17,033.
Monthly Software (Lease)	7,257.	7,257.	7,257.
Monthly Level 1 Cash Outflow (Purchase)	$ 29,102.	$ 29,102.	$ 29,102.
Monthly Level 1 Cash Outflow (Lease)	$ 24,290.	$ 24,290.	$ 24,290.
LEVEL 2			
Monthly Hdwre Cost (If Purchase - 3 yr)	$ 23,283.	$ 23,283.	$23,283.
Monthly Maintenance (If Purchase)	2,879.	2,879.	2,879.
Monthly Hardware (If Lease)	19,614.	19,614.	19,614.
Monthly Software (Lease)	3,229.	3,229.	3,229.
Monthly Level 2 Cash Outflow (Purchase)	$ 29,391.	$ 29,391.	$29,391.
Monthly Level 2 Cash Outflow (Lease)	22,843.	$ 22,843.	$22,843.
LEVEL 3			
Monthly Hdwre Cost (If Purchase - 3 yr)	$ 69,245.	$ 41,631.	$ 34,364.
Monthly Maintenance (If Purchase)	10,105.	18,030.	17,811.
Monthly Hardware (If Lease)	54,236.	N/A	N/A
Monthly Software (Lease)	10,152.	3,178.	6,025.
Monthly Level 3 Cash Outflow (Purchase)	$ 89,502.	$ 62,839.	$ 58,200.
Monthly Level 3 Cash Outflow (Lease)	$ 64,398.	N/A	N/A
LEVEL 4			
Monthly Hdwre Cost (If Purchase - 3 yr)	$ 56,361.	$ 52,838.	$ 53,005.
Monthly Maintenance (If Purchase)	14,520.	18,757.	14,666.
Monthly Hardware (If Lease)	51,687.	N/A	N/A
Monthly Hardware (Lease)	-0-	1,505.	1,305.
Monthly Level 4 Cash Outflow (Purchase)	$ 70,881.	$ 73,090.	$ 68,976.
Monthly Level 4 Cash Outflow (Lease)	$ 51,687.	N/A	N/A
TOTAL VCCS - ALL LEVELS	Alternative 1	Alternative 2	Alternative 3
Monthly Hdwre Cost (If Purchase - 3 yr)	$ 168,204.	$ 137,067.	$ 129,967.
Monthly Maintenance (If Purchase)	30,034.	42,186.	37,886.
Monthly Hardware (If Lease)	142,570.	36,647.	36,647.
Monthly Software (Lease)	20,638.	15,169.	17,816.
Monthly Cash Outflow (Purchase)	$ 218,876.	$ 194,422.	$ 185,669.
Monthly Cash Outflow (Lease)	$ 163,208.	*$ 186,240.	*$ 174,309.
Annual Cash Outflow (Purchase - 3 yr)	$ 2,626,512.	$ 2,333,064.	*$ 2,228,028.
Annual Cash Outflow (Lease)	$ 1,958,496.	*$ 2,234,880.	*$ 2,091,708.

TABLE 10.1

COST ANALYSIS SUMMARY BY LEVELS
PAGE 2

*These Totals Include Purchase Price of Hewlett-Packard Equipment Since Lease Arrangement is Not Available.

Current Total Cost of Computing in VCCS: Monthly = 163,712.
Annual = 1,964,544.

Alternative 1: Consists of all new IBM compatable equipment at each of the four levels.

Alternative 2: Consists of all IBM compatable equipment at levels 1 & 2, new Hewlett-Packard equipment and existing Hewlett-Packard equipment with appropriate upgrades at levels 3 & 4.

Alternative 3: Consists of all new IBM compatable equipment at levels 1 & 2, and existing IBM 138 along with new and upgraded existing Hewlett-Packard equipment at level 3. Level 4 consists of new IBM compatable and new Hewlett-Packard equipment.

Note: Telecommunications cost to support the Master Plan will be less than the $20,000 monthly cost presently being paid in the VCCS. Cost analysis will be forthcoming.

The third step of the financial analysis included analysis of the alternatives according to pre- established criteria. This analysis resulted in the selection of alternative 1 - IBM compatible computer hardware at all computing locations throughout the network. See Chapter 8.

Price quotes were informally requested for planning purposes from the IBM corporation and the Hewlett-Packard company because their equipment and software presently exist in the VCCS network. These two vendors had the expertise and personnel locally to respond to such a request in a timely manner.

Each computing location was configured with maximum capability to satisfy both administrative and academic computing requirements. Actual requirements will be determined using sizing techniques once decisions are made relative to size, number of computers and the computing functions to be performed at each location and each network level.

All costs for proposed hardware, software, and maintanence are included in detail in Appendix J.

10.1.1 Financial Analysis

For the purpose of this analysis, the projected cash flow for the purchase and lease options of three alternative configurations are compared on the basis of the net present values of the projected cash flows. The life of each option is assumed to be three years for purposes of comparison. The discount rate used is 10%.

The total annual cash flow for each option is estimated over a three year period (as recommended by DMASD) and listed in Table 10.1.1.

Table 10.1.1

Three Year Cost Comparison

ALTERNATIVE 1

Purchase of all IBM Compatible Equipment

FISCAL YEAR	PURCHASE	MMC	SOFTWARE LEASE	TOTAL
Year 1	2,018,448	360,408	247,656	2,626,512
Year 2	2,018,448	385,636	247,656	2,651,740
Year 3	2,018,448	412,631	247,656	2,678,735

Lease of all IBM Compatible Equipment

FISCAL YEAR	LEASE	MMC	SOFTWARE LEASE	TOTAL
Year 1	1,710,840	NONE	247,656	1,958,496
Year 2	1,796,382	NONE	247,656	2,044,038
Year 3	1,886,201	NONE	247,656	2,133,857

ALTERNATIVE 2

Purchase of IBM Compatible Equipment at Levels 1 & 2 and H-P Equipment at Levels 3 & 4

FISCAL YEAR	PURCHASE	MMC	SOFTWARE LEASE	TOTAL
Year 1	1,644,804	506,232	182,028	2,333,064
Year 2	1,644,904	541,668	182,028	2,368,500
Year 3	1,644,804	579,585	182,028	2,406,417

Lease/Purchase of IBM Compatible Equipment at Levels 1 & 2 and H-P Equipment at Levels 3 & 4

FISCAL YEAR	LEASE	PURCHASE	MMC	SOFTWARE LEASE	TOTAL
Year 1	439,764	1,133,628	441,444	182,028	2,196,864
Year 2	461,175	1,133,628	472,345	182,028	2,249,176
Year 3	483,839	1,133,628	505,409	182,028	2,305,904

ALTERNATIVE 3

Purchase of IBM Compatible Equipment at Levels 1 & 2 and IBM and H-P Equipment at Levels 3 & 4

FISCAL YEAR	PURCHASE	MMC	SOFTWARE LEASE	TOTAL
Year 1	1,559,604	454,632	213,792	2,228,028
Year 2	1,559,604	482,456	213,792	2,259,852
Year 3	1,559,604	510,779	213,792	2,284,175

Lease/Purchase of IBM Compatible Equipment at Levels 1 & 2 and IBM and H-P Equipment at Levels 3 & 4

FISCAL YEAR	LEASE	PURCHASE	MMC	SOFTWARE LEASE	TOTAL
Year 1	439,764	1,048,428	389,724	213,792	2,091,708
Year 2	461,175	1,048,428	417,004	213,792	2,140,976
Year 3	484,839	1,048,428	446,195	213,792	2,193,254

These figures include a 5% yearly increase in leasing costs and a 7% yearly increase in the maintenance costs after the first year of the lease or maintenance agreement. The purchase costs will remain the same throughout the purchase agreement. The software lease cost should remain static over a three year period.

10.1.2 Criteria for Selection

Listed below are the cost benefits that will be realized from the selected alternative.

1. Allows for equipment leasing resulting in less cash outflow.

2. Provides flexibilty in maintaining a State-of-the-Art computing environment due to transferability and discontinuation of equipment leasing.

3. Allows total compatibilty in the network resulting in:

   a) A single set of programs.

   b) A single program maintenance effort.

   c) Expertise being needed only on one vendor's equipment.

   d) Less difficulty in maintaning the network.

4. Requires less development cost due to the ability to utilize shared development in a totally compatible environment.

5. Has the flexibility to share hardware among colleges.

The discounted cash streams are as follows:

Alternative 1	- Purchase	$6,591,830
	- Lease	$5,072,940
Alternative 2	- Purchase	$5,886,380
	- Lease/Purchase	$5,588,430
Alternative 3	- Purchase	$5,609,260
	- Lease/Purchase	$5,318,780

On the basis of simple discounted cash flows, the lowest cost alternative is Alternative 1 - Lease of IBM compatible equipment.

10.2 PERSONNEL COST

The annual cost of existing data processing personnel in the VCCS as of July 1, 1981 will be $1,848,461 (includes 9% increase). The VCCS share of personnel cost at the Consolidated Center as of July 1, 1981 will be $278,455 (includes 9% increase). The total personnel cost to VCCS as of July 1, 1981 will be $2,126,916 (includes 9% increase).

The cost of additional personnel as shown in Chapter 9 to operate the recommended alternative at all levels will be $387,258.

To arrive at the cost for the Consolidated Center, one half of the current Consolidated Center personnel budget plus fringe benefits were used. The additional cost indicated to support the proposed plan was derived by determining the additional positions needed in the VCCS, applying the state salary scale to each and adding a percentage factor for fringe benfits. Chapter Nine (Section 9.4) displays the increased personnel requirements by position.

10.3 CONSOLIDATED COMPUTER FACILITY

The previous chapters of this Plan provide a detailed presentation of the advantages and disadvantages of distributed processing as compared to centralized processing. As a result of the extensive analysis completed in this planning process, the VCCS Executive Management has determined that a distributed processing network will best support the needs of VCCS in relation to both administrative and academic processing. Justification and implementation strategies are presented in Chapter Eight of this Plan. One of the remaining major issues to be resolved before implementation of the distributed processing system can continue, is the future role of the Consolidated Computer Facility in relation to the VCCS computing direction.

The Consolidated Computer Facility as the central host Center provides the only administrative computing capability available to seventeen of the twenty-three community colleges, as well as the System Offices. The Center also provides some assistance to the six colleges having on site computing capability. This existing relationship between the Center and the VCCS colleges represents a more centralized approach to computing which is contrary to the proposed VCCS computing direction. As indicated in this Plan, more computing capability will be extended to remote locations thereby reducing the need for a large and complex central host. There will always be a requirement, however,

in the VCCS for a computing facility that can process large volumes of data and relatively complex programs on a periodic basis. If the Center is to continue to play a role in the VCCS, its mission needs to be changed to accomodate the VCCS direction.

As indicated, this Proposed Computing Environment reflects a substantial reduction in funds presently allocated to support a network host. For the purpose of this Plan, a network host was configured (See Appendix J) that would provide the same basic capabilities presently available at the Center. It was anticipated that some of the additional funds saved by reducing the need for a central host could be used to help support the distributed computing system.

Since the Virginia Commonwealth University is so intimately involved in the Consolidated Computer Facility, it was not felt that a final decision could be made related to the role of the Center, if any, in the VCCS Computing System without input from VCU. It is, therefore, recommended that a joint Task Force be sponsored by both institutions to determine the possible role of the Center in the VCCS network and whether diminished usage or deconsolidation of the Center is indicated. The Joint Center Policy Board is expected to consider the formation of such a Task Force and its charge. Since both institutions are involved in a planning process, it is hoped that such a group can be formed and can reach required recommendations in a timely fashion.

10.4 COST REQUIREMENTS FOR PHASED IMPLEMENTATION

This section differs somewhat from previous section since it takes advantage of the in-depth study and lastest findings of the Networking Task Force. The preliminary Task Force report recommends the establishment of a third regional center to provide more equitable balancing and reduced telecommunications cost. Implementation will consist of a phased approach where some parallel cost will be required initially while displacement cost will occur during implementation as new equipment is installed and tested and old equipment is discontinued. The following chart (Figure 10.4 - A) represents the cost analysis of this phased implementation. Section 1 of the chart shows the proposed additional costs for each phase required to support the plan. Section 2 shows the portion of the existing costs that will remain after implementation. Section 3 indicates the existing costs that will be eliminated during the various phases of implementation.

Section 4 represents the total funds required to support the plan during each phase of implementation and after full implementation. The figures in Section 4 reflect all known costs for each phase and this "Phase Cost" is accumulated and brought forward to the next phase. Therefore, the $5,988,474 shown as the total at the bottom of phase 3 represents the total required funding to support the fully implemented VCCS Computing Master Plan. Note that these costs reflect today's costs and must be inflated according to the rate of implementation.

FIGURE 10.3
COST ANALYSIS OF IMPLEMENTATION

RESOURCES	CURRENT	PHASE 0	PHASE 1	PHASE 2	PHASE 3
SECTION 1:					
PROPOSED ADDITIONAL					
Hardware	-0-	160,728	546,132	410,796	458,250
Software					
Personnel	-0-	81,484	125,053	35,616	145,105
Telecommunications	-0-	19,724	130,000	66,000	84,000
SUB-TOTAL		261,936	801,185	512,412	687,355
SECTION 2:					
EXISTING - ONGOING					
Hardware	2,012,876	2,012,876	2,173,604	2,550,222	2,845,328
Software					
Personnel	2,092,392	2,092,392	2,173,876	2,298,929	2,334,545
Telecommunications	339,756	339,756	359,480	339,480	339,480
SUB-TOTAL	4,445,024	4,445,024	4,706,960	5,188,631	5,519,353
SECTION 3:					
DISPLACEMENT COST					
Hardware & Software	-0-	-0-	(169,514)	(115,690)	(134,234)
Telecommunications			(150,000)	(66,000)	(84,000)
SUB-TOTAL			(319,514)	(181,690)	(218,234)
SECTION 4:					
TOTAL TO SUPPORT PLAN					
Hardware	2,012,876	2,173,604	2,550,222	2,845,328	3,169,344
Software					
Personnel	2,092,392	2,173,876	2,298,929	2,334,545	2,479,650
Telecommunications	339,756	359,480	339,480	339,480	339,480
TOTAL	4,445,024	4,706,960	5,188,631	5,519,353	5,988,474

Phase 0

This start-up phase consists of installation of the Eastern Regional Center. This will require five additional support personnel to support the regional center and increased requirements for college personnel as conversion of the Student Information System and other systems development begins.

Phase 0 Costs

Personnel	Level	Number	Cost
		5	81,484
Hardware and Software	2	1	160,728
Tele-communications			19,724
TOTAL PHASE 0			261,936

Phase 1 Costs

Phase 1 will involve the installation of a level 2 Regional Center at Northern Virginia Community College and a level 3 cooperative center at Virginia Western Community College. Additionally, there will be eleven level 4 RJE terminals established or enhanced at the following locations:

Northern Virginia	- All 5 Campuses
Tidewater	- All 3 Campuses
Thomas Nelson	1
New River	1
Blue Ridge	1
	11 Total

During this phase, a total of seven additional positions are needed: four systems development personnel and three operations personnel.

Phase 1 Costs

Personnel	Level	Number	Cost
		7	125,053
Hardware and Software	2	1	139,440
	3	1	77,760
	4	11	328,932
Tele-communications (modems, lines)			130,000
TOTAL PHASE 1			801,125

Phase 2

Phase 2 is expected to have a level 2 regional center installed at Virginia Western, four level 3 cooperatives to be located at New River, Blue Ridge, J. Sargeant Reynolds and Thomas Nelson. One level 4 RJE terminal is scheduled to be installed at J. Sargeant Reynolds' Goochland campus during this phase. Three additional operator position's will be needed during this phase to support the level 2 regional center to be located at Virginia Western. Some displacement costs are expected during this phase in reduced rentals, maintenance and discontinuations of some equipment. Telecommunication costs are also expected to be reduced to a limited degree.

Phase 2

Personnel	Level	Number	Cost
		3	159,825
Hardware and Software	2	1	105,240
	3	4	289,584
	4	1	15,977
Tele-communications			66,000
TOTAL PHASE 2			512,412

Phase 3

Phase 3 includes the installation of three additional level 3 cooperatives at Southwest, Central Virginia and John Tyler. Also, the remaining fourteen level 4 RJE terminals will be established or enhanced at the following colleges:

Dabney Lancaster	Piedmont Virginia
Patrick Henry	Lord Fairfax
Wytheville	Germanna
Mountain Empire	Southside (2 campuses)
Virginia Highlands	Danville
Rappahannock	Eastern Shore
Paul D. Camp	

An additional eight positions will be needed to support this phase of implementation.

Phase 3

Personnel	Level	Number	Cost
		8	20,896
Hardware and Software	3	3	206,262
	4	14	251,988
Tele-communications (modems & lines)			84,000
TOTAL PHASE 3			687,355

10.5 SUMMARY

This chapter depicts the financial implications of the Planning Model for the purpose of the Master Plan. It does not represent the final costs since these must be determined by the Request for Proposal process. The preceeding charts and narratives represent recurring costs to implement and maintain the Planning Model.

While it is certainly recognized that the cost of the new approach involving the distributed network is more than the current expenditure, it does provide tremendously improved capacities over the current deficit for students and administration of the VCCS. These benefits and improvements are discussed in detail in Chapter 8.

It should also be noted that additional personnel will be required which is a significant part of the increased expenditure over the current budget. While it is recognized that the VCCS must attempt to remain within current targets, it is also recognized that insufficient personnel currently exists within the Data Processing area. Most of the increased positions which are critical to the success of the Plan are already being funded in other areas but will be channeled to Data Processing functions as automation increases and allows reduction from other areas.

In addition to the costs included in the foregoing sections, there will be additional costs related to facility preparation, training, technical publications, and certain overhead associated with computing supplies. These items are, however, outside the scope of this Planning Model.

It is also recognized that during the implementation of the phases certain resources such as extraneous maintenance, equipment, software, and other resources will be either displaced or substituted. The cost of computing within the VCCS will be offset to some degree by these displacements. The Planning Model indicates recommended displacements during the phased implementation. Further cost analysis and examinations will occur during the Request for Proposal process which will follow the approval of this Master Plan.

It should also be noted that the foregoing charts represent current costs. Inflation factors must be included in the final analysis according to implementation schedules.

Chapter 11

IMPLEMENTATION

This chapter addresses an action plan to implement the VCCS Computing Services Master Plan. Specific tasks to be accomplished, their timetable and assignment of responsibility are highlighted for articulating the Plan and for implementing the distributed computing network, the development of administrative applications and the support of academic computing. Given the scope and complexity of this, numerous tasks will be undertaken concurrently.

11.1 ARTICULATION OF PLAN

The Plan must be acceptable to the colleges, System Offices and MASD if it is to be advanced in a timely, efficient and effective manner. Everyone must understand the significant departure this Plan represents from the current diverse computing strategies as well as all previous computing efforts in the VCCS. For this reason, the following articulation tasks will be accomplished to gain wide acceptance of the Plan:

ACTION TASK	RESPONSIBILITY	COMPLETION DATE
1. Present Plan to Chancellor's Staff	Vice Chancellor for Academic Affairs & Planning, and Dir., Data Services	4/7/81
2. Present Plan to Presidents	Vice Chancellor for Acad. Affairs & Planning, and the Executive Comm. of VCCS Computing Serv. Planning Committee	4/16/81
3. Present Plan to MASD & Secretary of Education	Vice Chancellor for Academic Affairs & Planning, and Dir., Data Services	4/20/81
4. Present Plan to Colleges	Executive Committee	5/1/81

5. Present Plan to VCCS Board	Vice Chancellor for Academic Affairs & Planning	5/20/81

11.2 IMPLEMENTATION OF DISTRIBUTED NETWORK

It is imperative that the VCCS proceed as rapidly as possible with the implementation of the distributed network since this configuration represents the backbone of the Plan. The following tasks have been identified to establish the distributed network structure:

TASK	RESPONSIBILITY	COMPLETION DATE
1. Determine the network configuration that will best serve the needs of the VCCS.	Network Configuration Task Force	4/15/81
2. Develop and submit an Agency Procurement Request (APR) for the distributed computing network.	Data Services Staff	4/15/81
3. Finalize Computing Serv. Distributed Network Configuration.	VCCS Computing Serv. Planning Committee, Data Services Staff	4/20/81
4. Develop requirements for a Data Base Management System and recommend a DBMS package.	Data Base Management System Task Force	5/1/81
5. Prepare the first cut of the Request for Proposal (REP) for the distributed computing network.	Executive Committee & Technical Task Force	5/1/81
6. Establish guidelines to aid the colleges in the preparation of cooperative computing plans.	Director of Data Services	5/1/81
7. Finalize operating system, telecommunications and data base management system software.	VCCS Computing Serv. Planning Comm. & Data Services Staff	5/15/81

8. Formalize the initial Hardware Cooperatives.	College Presidents, VCCS Computing Serv. Planning Committee	5/15/81
9. Establish a model agreement governing the operation and financing of the Cooperatives.	Director of Data Services	5/15/81
10. Develop detailed statements of responsibilities and operating procedures for all levels of the VCCS Computing Services System.	Director of Data Services	6/1/81
11. Identify and request the additional positions as well as reallocations required to support the Plan.	Director of Data Services	6/1/81
12. Develop cooperative plans.	Colleges	6/1/81
13. Provide for the training of personnel required to operate and maintain the various computing centers.	Director of Data Services	7/15/81 11/15/81 2/15/82 6/15/82
14. Acquire & install the regional computers and several college cooperative computers.	VCCS Computing Serv. Planning Committee	8/1/81
15. Acquire and install additional college cooperative computers.	VCCS Computing Serv. Planning Committee	12/1/81 3/1/82 7/1/82
16. Initiate planning for networking all computing centers.	College Cooperatives & Data Services Staff	1/1/82
17. Determine the most efficient placement of the central host function and establish, if required, within the VCCS distributed computing network.	VCCS Computing Serv. Planning Committee	3/1/83

11.2.1 Disposition of Existing Incompatible Hardware

A major and profound concern is the disposition of incompatible hardware, in particular the Hewlett-Packard computers in five of the VCCS colleges. There seems to be little argument that a transition plan must provide for continuing support of this incompatible equipment until equivalent computing service can be provided by the fully compatible distributed network. However, there remains the question of what to do with incompatible equipment that is providing services capable of being duplicated by the distributed network. Should the equipment be retained to support specific computing services and offload the fully compatible network?

The issue must be examined in terms of cost and effectiveness. Effectiveness must be addressed in terms of computing independence and level of service. Specific computing service that can be independent of all other computing services must be identified. It does appear that such VCCS computing services exist, making it feasible to utilize a separate hardware network, functioning independently of the full compatible distributed network. Such computing alternatives may possibly include, but not necessarily be limited to the following:

1) Academic Computing - (Basic)
2) Student Guidance Information
3) Unique Computing Services for a particular college

Accepting these computing alternatives as appropriate uses of the equipment, the final decision must be made based on cost and level of service. The solution must be cost effective. The cost of maintenance for Hewlett-Packard computers, the software rental cost, and the personnel cost for supporting the Hewlett-Packard computing services must be compared with the cost of providing computing service on the distributed network. Also, the level of service and implication for future growth requirements for more incompatible equipment must be carefully evaluated.

11.3 ADMINISTRATIVE APPLICATION DEVELOPMENT

The major thrust of all future development efforts will be in the context of coordinated shared development, including college and System Office personnel. Through this coordinated effort, it is expected that a single primary system-wide application software will evolve for each functional area.

The first priority to be accomplished will be the conversion of the Hewlett-Packard and Northern Virginia SIS related systems. Further discussion of this priority is presented in 11.3.1. Beyond the SIS, every effort will be made to purchase and/or acquire application software whenever possible to eliminate the need for large numbers of additional analysts and programmers.

The following tasks have been identified to begin the shared development activities:

	TASK	RESPONSIBILITY	PROJECTED COMPLETION DATE
1.	Develop an initial VCCS Data Element Dictionary for the Student Information System and associated systems.	Student Information Data Element Dictionary Task Force & SIS Conversion Task Force	8/15/81
2.	Pilot test the converted interactive systems and conduct training of college personnel.	Student Information System Conversion Task Force	2/1/82
3.	Initiate and complete the conversion of both the H-P and No. Va. Student Info. Systems and associated systems.	Student Information System Conversion Task Force	6/1/82 (See Appendix K for a suggested timetable of the conversion effort)
	Implement the converted systems.	Dir., Data Services College Coorperatives	2/1/82
5.	Initiate the development of a Student Reporting System for the Systems Offices and produce a deliverable by the 1983 Winter Quarter.	VCCS Planning & Evaluation	1/1/83
6.	Modify and migrate some major applications and functions to a central host capability in the VCCS Distributed Computing Network from the Consolidated Computer Facility.	VCCS Data Services Staff	3/1/83
7.	Complete migration of all applications to central host capability.	VCCS Data Services Staff	6/1/83

11.3.1 Student Information System Development

A special task force was established to evaluate alternatives for utilizing the SISs developed at the five Hewlett-Packard colleges and NVCC. The task force developed an inventory of software as of June 1, 1981, which could be made ready for conversion to operate in the new IBM-compatible distributed network.

The conclusion of this effort is to convert both the H-P and and Northern Virginia SISs and related systems, utilizing (a) a common data base design, (b) common data editing and coding standards, (c) similar security standards and (d) similar structured programming techniques. This decision is based on the following considerations:

1. The two existing systems effectively serve 66% of the total VCCS enrollment.

2. Primary subsystems have been designed, tested and fully integrated into the operational environments of large, medium and small size colleges and/or campuses.

3. Discontinuance of either system would result in a considerable and unnecessary waste of resources, both past and future, since one user group would have to reorganize and retrain to adopt a different system design.

4. The availability of both systems converted to the VCCS distributed network would provide an SIS sooner and with more flexibility to meet user requirements.

5. The direct and indirect costs to convert both systems to produce a package of software with standard and optional features would be less disruptive to operational stability and avoid unnecessary diversion of development resources, than costs incurred from eliminating one system and converting the other system to fit 23 varying operational settings.

6. Redesign and redevelopment costs are essentially avoided by converting the two systems to provide a base package with which VCCS colleges can receive readily adaptable and operational computer-based SIS support to satisfy critical institutional needs.

7. Staff morale and motivation necessary for productive participation and a unified computing environment specified in the Plan would be preserved through the cooperative conversion of both systems, since the

software products developed with considerable investment in human energy and time would be carried forth as a foundation for new and demanding development efforts.

8. Shared conversion would provide valuable cooperative experience and coordination towards moving into the shared development concept for future SIS and other major systems. The six colleges currently using the two systems would be able to move into the shared development environment from a position of stability and strength, thereby increasing the VCCS's ability to move ahead with effective and efficient systems development and management, and consequently more effective overall management of the VCCS.

The college cooperatives will select the SIS most appropriate for their management philosophy and operating procedures.

11.4 ACADEMIC COMPUTING SUPPORT

There is extreme urgency in providing academic computing support to the colleges. The basic classifications of academic computing support and associated needs are addressed in Appendix E. The following list of tasks have been identified to support academic computing:

TASK	RESPONSIBILITY	PROJECTED COMPLETION DATE
1. Establish the Academic Computing Users Committee	Computing Services Planning Committee	7/1/81
2. Pilot test academic computing software.	Academic Computing Users Committee	9/1/81
3. Articulate academic computing capability to college personnel.	Academic Computing Users Committee	9/15/81
4. Conduct at least one system-wide symposium on academic computing.	Academic Computing Users Committee	11/15/81
5. Provide for academic computing capability at all 23 colleges.	Academic Computing Users Committee	7/1/82

Chapter 12

MANAGEMENT AND COORDINATION

12.1 VCCS MANAGEMENT PHILOSOPHY

The new management philosophy for the VCCS as approved by the State Board for Community Colleges in its meeting of August 16, 1979 states:

"the VCCS central staff (System Offices) shall focus on management review and oversight functions thereby delegating maximum authority to presidents for the day-to-day management of the individual colleges."

Specifically, more responsibility and corresponding authority are being delegated to the college presidents. This transfer means that presidents are to be held accountable for all aspects of the decision-making, management, and operational responsibilities delegated to the individual colleges. As a result, colleges are assuming a more agressive posture in managing their own affairs.

The principal functions of the VCCS System Offices under this management concept consist of System-wide planning, policy/procedure development, and management oversight. The planning function provides long-range, medium-range and short-range plans, establishing the framework for all college programs and services including computing services. The State Board for Community Colleges approves plans prior to implementation. Such approvals are announced and implemented in the same manner as other Board approved policies and procedures.

The implementation of Commonwealth directives and other matters of a policy and procedures nature emanating from the Governor and his Secretaries which do not require action by the State Board are translated into VCCS policies and procedures by the VCCS System Offices for implementation by the colleges. Further, the System Offices coordinate the development of System-wide policies to be approved by the State Board through the Advisory Council of Presidents, local boards, and ad hoc and standing committees. The State Board has final authority over state-wide policies, with the System Offices monitoring compliance through various policy analysis and evaluation activities.

After necessary planning and translation of plans and other requirements from the Governor and his Secretaries into policies and procedures, management review and oversight functions envisioned by the Board are exercised by the System Offices. This includes reviews, spot checks and audits consistent with a "management by exception" concept. The necessity of checking every transaction which comes forward from the member colleges of the Virginia Community College System is precluded. The role of the System Offices focuses on management review and auditing responsibilities, in such functional areas as the acquisition and utilization of resources.

The Presidents of the various colleges manage their institutions and are responsible for all management activities and decision-making which has been delegated to them. The necessary policy guidance and procedural publications are furnished to assure that the System operates with decentralized management in a relatively uniform and efficient manner. The Presidents are responsible for the performance of their respective colleges, and their performance is measured in their ability to manage institutional resources effectively and efficiently.

12.2 PLANNING OF THE VCCS COMPUTING SERVICES SYSTEM

The overall planning of VCCS Computing Services is the responsibility of the VCCS Computing Services Planning Committee. This responsibility includes:

1. Maintaining an updated computing services plan which is synchronized with System-wide planning and budgeting cycles;

2. Establishing priorities for systems development, hardware/software acquisitions; and the acquisition of other resources;

3. Appointing project teams and task forces to accomplish computing services objectives;

4. Reviewing progress towards completing Plan objectives and publishing an annual report;

5. Coordinating and recommending policies on major issues that affect computing services in the VCCS;

6. Providing final recommendations on the settling of differences concerning project development efforts;

7. Maintaining an acceptable systems development methodology and approving guidelines and standards for all coordinated shared development projects;

8. Ensuring that the VCCS computing network provides an adequate level of academic computing resources and services in all 23 colleges.

The Planning Committee must pay particular attention to all coordinated shared development efforts. Shared development will require a committee structure which is outlined in Appendix D. This committee structure will promote the use of individual talent and expertise throughout the VCCS on a project-by-project basis. Through the committee structure, project team and task force level groups will represent end-users, thus encouraging extensive end-user participation.

Guidelines and standards for the coordinated shared development will ensure system compatibility and reduce long term system maintenance. All system design specifications will adhere to the SDM/70 format (modified). Programming standards will be incorporated specifying such items as variable naming conventions, file formats, language standards, etc.

12.3 ADMINISTRATION OF THE VCCS COMPUTING SYSTEM

At the top of the management structure, the State Board for Community Colleges will determine major organizational goals for computing services within the VCCS and will serve as the final decision maker. The Chancellor will approve major policies related to computing services as recommended by the Advisory Council of Presidents and the Chancellor's staff. The Vice Chancellor of Academic Affairs and Planning is a member of the Joint Computer Facility Policy Board and the Chancellor's staff and controls the internal data processing function within the System Offices and the overall functions of the VCCS Computing Services System. The Director of Data Services reports to the Vice Chancellor of Academic Affairs and Planning and provides common direction and communication throughout the system.

While deliverability of data processing services can be significantly improved in a distributed processing environment, the management and control of such an environment is necessary and must be coordinated on a centralized basis. However, to improve probability of success, the system will attempt to mirror the current organization as related to the concept of distributed

responsibility and local accountability. The strategy for accomplishing this will be an attempt to place computing resources, functions, and controls where they will be most useful and effective, with systems logically interrelated to allow management to control and utilize their organizations most effectively.

The addition of two new major functions will be necessary to guide and evaluate application development efforts. A quality assurance function will be established in VCCS Data Services to address compliance and conformity to established standards in the areas of development methodology, programming conventions; documentation; user sign offs; and master lists of System-wide applications as prioritized by the VCCS Computing Services Planning Committee and specified in the VCCS Computing Services Master Plan.

A data base administration function will be established in VCCS Data Services to oversee the identification and definition of data elements used commonly throughout the VCCS. The individual(s) charged with this management responsibility will maintain close contact with all user project teams to ensure that essential elements are addressed adequately, but also that no unnecessary data redundancy is built into the various appplications.

The Manager of Systems Development under the direction of the Director of Data Services will be responsible for day-to-day coordination and monitoring of shared systems development supporting System-wide administrative applications.

There are basically four areas of planning and administration in the VCCS Computing Services System:

1. Central Data Processing

   a) Consolidated Computer Facility

   b) System Offices

2. Regional Data Processing

3. College Cooperative Processing

4. College/Campus Data Processing

12.4 CENTRAL DATA PROCESSING (LEVEL 1)

Central data processing will consist of activities related to system wide utlization of resources including present activities associated with the Consolidated Computer Facility and Data Services. Overall management of central host processing will be the responsibility of the Director of VCCS Data Services under the Vice Chancellor of Academic Affairs and Planning. This is Level 1 of the distributed processing configuration as depicted in Chapter 8 (Figure 8.1.7).

12.4.1 Consolidated Computer Facility

The Consolidated Center presently operates a computing facility that augments and enhances the VCCS computing mission for academic programs administrative functions, research activities, and public service by providing effective support and computing resources in a timely manner. These resources include computing hardware, software, and technical and operational support services.

Since the Consolidated Center is jointly owned by the VCCS and Virginia Commonwealth University, management of this center will be slightly different from the other centers. The following strategies relate to this Center:

1. Major policies and decisions related to governance of the Consolidated Center will be the responsiblity of the Joint Computer Center Policy Board.

2. Serving as advisory staff to the Policy Board will be the Joint Computer User's Committee consisting of representatives from the colleges/university. The Directors of each of the institutions and the Director of the Consolidated Center will serve in an ex-officio capacity. The Director of VCCS Data Services will serve as Chairman of the committee.

3. Since the Consolidated Center is administratively housed under Virginia Commonwealth University and since VCU is anticipated to become the primary user of the facility, the Director of VCU data processing will serve as Executive Director of the Consolidated Center with the Director of VCCS data processing serving in an advisory capacity. Merit reviews and personnel actions related to the Director of the Consolidated Center will be completed jointly by the VCCS and VCU data processing directors and will require concensus. Each institutional director will

determine priorities for their own institution, review Center management reports, and determine relative priorities for the joint center projects.

4. A Council of Managers will consist of second line managers from the two institutions, the Director of the Consolidated Center, and the senior technician from the Consolidated Center. The group will be responsible for determining problem areas, recommending solutions, and proposing priorities and will report directly to the Directors of VCCS and VCU data processing.

12.4.2 System Offices

This area will include the overall planning and review functions for the system. It will consist of three basic user groups:

1. The VCCS Computing Services Planning Committee is responsible for system-wide planning and review for colleges in computing services. The committee includes representatives from the colleges and System Offices with the Director of VCCS Data Services serving as chairman.

2. The VCCS Director's Committee is responsible for System Offices planning and review for computing services. The committee will include each of the Directors at the System Offices.

3. The Management Review Committee is responsible for internal Data Services management and consists of the Manager of Systems Development, the Manager of User Support and Operations, and the Director of Data Services.

12.5 REGIONAL DATA PROCESSING (LEVEL 2)

Regional data processing will initially be supported at Northern Virginia and at least one other location. Data Services serves as the primary Test and Service Center for all the colleges and primary processing center for the colleges indicated in Chapter 8 (Figure 8.1). Northern Virginia serves as the primary processing center for the other colleges also depicted in Chapter 8 (Figure 8.1) and will serve as backup for the Test and Service Center for the distributed network. Control of the regional centers will

be administered by the Director of VCCS Data Services in conjunction with the VCCS Computing Services Planning Committee. Other Regional Processing Centers may be established in the future as needs dictate.

12.6 COLLEGE COOPERATIVE PROCESSING (LEVEL 3)

The college cooperative processing area includes the administration of remote computing centers for the purpose of providing cooperative and shared services among two or more colleges. The primary administrative function of these units is provided by College Presidents for colleges participating in a given cooperative. Local Management Groups consisting of data processing heads for participating colleges serves as staff for the consortiums of College Presidents with a representative from Data Services serving as an ex-officio member of each cooperative group.

The Remote College Processing Centers will be located at host colleges and will be shared in a cooperative venture. Management of these centers will therefore, be conducted by:

1. The Local Executive Committee, consisting of the Presidents of each college or an elected sub-group, involved in the Remote College Processing Center, will determine major priorities within the remote center and will review the progress of major activities.

2. The Local Management Committee, consisting of representatives from data processing sections from each of the participating colleges or an elected sub-group with the Director of VCCS Data Services serving as an ex-officio member, will serve as staff and a recommending body to the Local Executive Committee. The group will establish local performance criteria, measure progress, and insure adherance to standards and policies.

12.7 COLLEGE/CAMPUS DATA PROCESSING (LEVEL 4)

Data Processing Administration is concerned with local data processing requirements not related to system-wide or cooperative functions. Management of these functions are the responsibilities of local college Presidents and data processing staff with the System Offices serving in a management oversight and audit review role.

Chapter 13

PERFORMANCE STANDARDS

The major performance standards will relate to evaluating the Computing Services System as it is implemented. For example, one primary test will be the establishment and successful implementation of the Test and Services Center. Another measure will relate to the success in transferring the application systems installed in the Test and Services Center to other centers. Additional measures will relate to the success of acomplishing the action plans as related in Chapter 11.

Systems Development activities will be evaluated in terms of the development and timely implementation of a system-wide Student Information System, Course Schedule Management System, and a Student Reporting System. These will be key indicators for determining whether the Computing Services System is approaching proposed performance standards related to development.

The following criteria, conditions, or effects relate to the goals stated in Chapter 7 and are either wanted or not wanted in terms of:

1. Quantity
2. Quality
3. Time or Timeliness
4. Cost

The following criteria are designed to address the goals stated in Chapter 7.

1. Produce administrative applications which are characterized by:

   - Usefulness to all 23 colleges
   - Interactive when desirable and feasible
   - 3-5 second response rate when interactive
   - Developed as economically as possible through the use of productivity aids and/or the use of designs of successful applications at other colleges
   - Meet the unique needs of the colleges and the System Offices

2. Increase academic computing support to instruction in data processing techniques, computer managed instruction, problem solving, tutorials instruction and simulation at all 23 colleges.

3. Maintain a definitive operational VCCS master plan for computing services which provides overall direction to computing support and systems development according to biennial requirements and annual budget cycles which:

   a) Is in writing

   b) Has been presented to the Advisory Council of Presidents, the Chancellor, and external agencies such as the Department of MASD prior to the beginning of each planning period and has been approved

   c) Includes similar plans for regions and colleges

   d) Are based upon identified forecasts of future conditions that will have an effect upon the attainment of such plans

   e) Contain objectives that cover the total system including the colleges and System Office

4. Coordinate and manage both processing and systems development through a formalized organizational structure

5. Delegate responsibility for components of the VCCS Computing System to where ultimate accountability is retained and provides measures for evaluating and assuring accountability

6. Establish, customize, or purchase common application programs, vendor packages, utilities, compilers, operating systems, data base management and

communication systems throughout the VCCS whenever cost effective

7. Maintain one data element dictionary for the VCCS

8. Acquire computing hardware for the VCCS Computing Services Network which is compatible at the program level

9. Implement a standard methodology for all major systems development

10. Determine annual calendar of internal and external reporting requirements

11. Meet reasonable deadlines for reporting information to the external agencies, including SCHEV, Department of Planning and Budget, HEW, etc. as well as for internal use

12. Provide a network of computing hardware that maximizes transferabily among internal agencies, faclitates enhancements, and provides mechanisms for taking advantage of changing technologies

13. Establish effective project teams which include college and System Office representation to ensure that applications satisfy user needs and reflect the actual system and college processes. Establish and monitor standards for obtaining satisfactory applications

14. Establish a Test and Services Center and at least one backup site for network availability and control. Establish a strong central staff for controlling and maintaining network integrity

15. Provide VCCS personnel with an annual review of the results of the VCCS Computing Services' operations and activities

16. Provide a training session on at least a quarterly basis for colleges and System Offices in current state of the arts technology

17. Establish and implement a training calendar for requirements of the VCCS Computing Services System

18. Conduct at least one annual state-wide meeting on academic computing for interested faculty and staff

Chapter 14

PLAN MANAGEMENT

It is assumed that this Master Plan for Information Processing in the VCCS is dynamic in nature and that it will continue to evolve as time passes. In order that its evolution is as carefully managed as was its initial design, it will be the continuing task of the VCCS Computing Services Planning Committee to oversee its development and implementation.

The Committee derives its authority from the Chancellor and serves at his pleasure. All actions of the Committee take the form of recommendations to the Chancellor, made through the Vice Chancellor of Academic Affairs and Planning.

The Committee will adopt such operating procedures as may be necessary in order for it to monitor the following aspects of the plan:

1. Currency - The Plan will continually reflect state-of-the art design and technology as it describes the actual information processing environment of the VCCS and its prevalent needs.

2. Balanced implementation - The Plan will describe an integrated system of information processing services for the VCCS. It will respect the general concept of full implementation of planned essential services before approving projects apt to detract from their attainment. While it is recognized that individual colleges may progress at differing rates, an obligation exists to insure equitable development relative to those planned levels of service deemed appropriate for the various colleges.

3. Cost - The Plan will be attuned to the financial realities of the period which it describes. Significant expenditures should be planned with respect for the relevant budgeting cycles.

4. Acceptability - The Plan exists in a multi-institution and a multi-agency environment which dictates parameters of mutual acceptability. The Committee will remain sensitive to these limitations and maintain the Plan within them.

5. Revision - The Plan may be revised at any time, subject to the review of the MIS Planning Committee and the approval of the Chancellor. An annual review will take place each spring in order to assess performance against the Plan, to make necessary adjustments, and to expand the Plan to cover an additional year.

APPENDICES

Appendix A

ADMINISTRATIVE AND MANAGEMENT APPLICATIONS

This section outlines the various applications which are essential for supporting administrative and management decision-making concerning the processes of the colleges. The presentation of these applications will deal with the need for computer support to carry out these processes. Some may have already been developed, others are being developed, and still others are being proposed.

Scope and Goals

Administrative and management applications are required to provide computer support for planning, managing and measuring the resources, operations and the results of the colleges. To some extent the development of the applications has not kept pace with the increasing information demands, both from internal and external sources, and with the growth of the colleges.

The general scope of administrative and management applications is focused on the ability to enhance existing information processing services to provide greater support to:

1. Meet increasing day-to-day operational needs.
2. Provide services to students.
3. Provide higher quality, more accessible information for management decision-making.
4. Provide timely information for external reporting purposes.
5. Provide or increase support to expanding research and planning activities.

Goals to be obtained in these administrative and management applications include:

1. Applications must support both the colleges and the System Offices as they respond to changes in their environment.

2. The design, development, and implementation of any application must be supported by full user and technical documentation to meet the needs of the VCCS, the requirements of the Auditor of Public Accounts, and MASD.

3. Application requirements should be identified from the top down, through an assessment of the views, values, priorities and information needs of college management, with design, development and implementation from the bottom-up through the participation of operational staff.

4. Applications should be designed around the processes of the colleges, rather than around the organization of the colleges.

5. Applications should enhance the effectiveness of management decision-making, planning, and analysis.

6. Application design should promote efficiency and increased productivity in data processing functions.

7. Application design should promote use of common data elements, source documents, standards and conventions to ensure mutual sharing of software among the colleges.

8. The implementation of any new or modified application should be preceded by an adequate training program for all users.

9. All major applications must be designed to incorporate, as a minimum, VCCS data element requirements and support System-wide policies and procedures.

10. All VCCS design and development must utilize state of the art techniques wherever possible.

College processes

The planning of administrative and management applications must be oriented towards the goals of the community colleges and the processes/activities associated with achieving these goals. More explicitly, applications must be designed around the processes and activities of the colleges, rather than around the organization of either the VCCS System

Offices or individual colleges. Processes and their activities reflect the functions and tasks of the colleges, and the organization supports the execution of these processes.

The processes and associated activities shown below are identified from the applications which have been developed or need to be developed to support information needs:

Processes	Activities
Student/Alumni	Admissions
	Registration
	Student Record-Folder
	Student Finances
	Financial Aid
	Veterans
	Counseling
	Grading/Transcripts
	Health Services
	Graduation
	Job Placement
	Alumni
	Student Obligations
	Career - Academic
	Industrial Training
Financial	Financial Accounting
	Local Funds Accounting
	Budgeting
	Purchasing
	Equipment Inventory
	Supplies Inventory
Personnel/Payroll	Applicant Processing
	Personnel Record Management
	Position Control
	Payroll Processing, Reporting and Expense Distribution
	Education/Training Development
	Leave Management
	Course/Schedule Interface
	Education/Training Development
Community Education	Continuing Education Unit
	Public Service Activities
Course/Schedule Management	Course Dictionary
	Course/Schedule Management
	Quarterly Class Schedule
Faculty Management	

Facilities Management	
	Facilities Inventory
	Facilities Utliization
Learning Resources	
	Acquisitions
	Cataloging
	Circulation
	Serial Control
Research and Planning	
	Student Follow-up
	Student Retention
	VA Information Exchange (VAIEP)
	Student and Enrollment Characteristics
	Enrollment Projections
	Budget Planning
	Facilities Utilization Analysis
	Faculty Productivity Analysis
	Institutional Resources
	Analytical Reporting
	Graduate Placement and Follow-up
Foundation	
	Donor Reporting
	Funds Disbursement

Data Element Dictionary

As indicated earlier, most computer applications that support the various college processes/activities will have a common thread of VCCS data elements, whether the application's data base resides at the VCCS or at the colleges.

To establish the VCCS data elements for each major application area, an ad hoc group will be appointed to review and select data elements for incorporation into the VCCS Data Element Dictionary. Once this initial task is completed, the VCCS Computer Services Planning Committee will oversee periodic review and update to this data element dictionary. The overall maintenance of the data element dictionary will be the responsibility of the data base administrator within the office of VCCS Data Services. The System Offices shall also assume responsibility for monitoring each VCCS data element in terms of: (1) purpose; (2) data element structure; (3) frequency and (4) accuracy. Purpose reflects intended use, the relationship to a college process/activity and the source for collecting this element. Structure means precise definition, title, and alpha/numeric characteristics. Frequency concerns how often the data element should be collected; i.e., regularly and routinely, or only for special occasional purposes. Accuracy applies to both reliability and completeness of data being collected.

Frequently similar non-VCCS data elements are employed in more than one institution. Whenever possible, similar formats should be used when establishing local data elements to increase commonality among colleges. For example, while student address may not be a VCCS data element in the future, the data element structure should remain consistent across all 23 colleges.

A.1 VCCS INFORMATION SYSTEMS

The following is a list of the applications The VCCS Data Services and the colleges plan to implement during the next six years. Many of the applications already exist in some state while others will have to be developed or acquired. This is intended to present the scope of the administrative systems development effort required on a system-wide basis.

STUDENT INFORMATION - This system encompasses a series of subsystems which are used to provide both services to students and information on these students to operational and management users. This system encompasses a data base containing biographic, demographic, enrollment, program placement and achievement, and status information about students. The student data base must have direct linkage to the Course/Schedule Management System and the Financial Accounting System.

Admissions - This subsystem encompasses all of the activities involved in handling student applications, classifying admitted students into appropriate curricular and non-curricular catergories and providing specified individual student elements for utilization of other information subsystems.

Registration - This subsystem supports both the preparation of students for the registration process and the registration process itself including early registration, registration, late registration and add/drop activities.

Student Record Folder - This subsystem is utilized to create and maintain permanent student records including the permanent record card, transcripts and reports related to academic status and achievement.

Financial Aid - This subsystem integrated with the Admissions Subsystem and the Financial Accounting System enables a college to process applications for financial assistance, and to identify, expand and account for student financial assistance monies from a

variety of sources. This subsystem would provide for major financial aid reporting requirements and possibly internal analysis.

Veterans - This subsystem is used to monitor enrollments, program expenditures, (e.g., VCIP, veterans work study, etc.), academic status and progress, attendance, etc., for students enrolled under assistance from the Veterans Administration.

Counseling - This subsystem supports the counseling function and will be used to profile students relative to information from standardized evaluation and from the counseling/advising activities, (e.g., curricular and career choices, work experience, data prior educational records, etc.).

Graduation - This subsystem is designed to enable the college to maintain a working file of potential graduates. This subsystem will allow the college to prioritize multiple degrees and to report students completing program requirements in accordance with external agency requirements.

Alumni - This subsystem would contain data on individual alumni and other specified ex-students of the college. This information would be maintained for the purpose of improving the ability to contact alumni and orient these ex-students towards assisting in the support of the institution. This support may be in the form of direct monetary contribution, establishment of an endowment for the expansion of capital facilities, the rendering of assistance in placing students in jobs, activities directed toward helping student recruitment or any other area in which the college might desire the support of former students.

Health Services - This subsystem would maintain all required student health records for access by the college nurses.

Job Placement - This subsystem would maintain the students seeking full-time and part-time positions to be matched in a timely manner with a number of potential employees. This subsystem would support inquiries from both students and employers.

Grading/Transcripts - This subsystem would maintain the student academic record with the capability to compute grade point average, flag academic probation and suspension, and generate transcripts.

Student Finances - This subsystem would maintain and update student payment history and generate agency bill statements. This subsystem would tie in with the registration subsystem.

Student Obligation - This subsystem would place "hold" on students who have unfilled obligations with the colleges. Overdue books and unpaid parking fines are among the possible causes of an obligation preventing the student from registering until it is resolved. A bad check flag would appear for the business offices in the Student Financial Subsystem.

Career/Academic - This subsystem would assist the student in matching interest and aptitude with a career and course of study.

Student Activities - This subsystem is to aid efforts of student activity counselors in promoting student organizations and other extra-curricular activities by matching and grouping student interest data.

STUDENT REPORTING - The intent of the Student Reporting System will be to incorporate many individual student systems, files, and data bases into one student reporting system and data base. This will result in the elimination of the existing systems, files, and data bases, and will also facilitate the processing of information, and the printing of reports. Reports involved in this sytem will include all official Enrollment and FTE Reports to the State Council of Higher Education, and the Federal Government, as well as Financial Aid and Statistical Reporting to the Office of Civil Rights and Office of Education. The systems that would be replaced are as follows:

* Graduate System (Reporting Functions)
* Enrollment System
* AKT Reporting System
* Financial Aid System (Reporting Functions)
* Unduplicated Students System
* VEDS Academic Reporting System (Reporting Functions)
* Educational Programs

COMMUNITY RESOURCES ANALYSIS - A file of community resources in the service area, including businesses, industries, and organizations, is needed to determine potential from which the college may have access to information. This data will will be useful for research and planning purposes, such as needs assessment studies, curriculum planning, cultural events, public relations and information, etc.

DATA ELEMENT DICTIONARY - This system will be designed to provide a computerized tool for the management and control of VCCS data resources. This system will consist of a structured file containing data definitions of all data and processes used in the VCCS. The system will be developed so that a complete picture of relationships between data and data, between data and processes, and between processes and processes can readily be determined.

INDUSTRIAL TRAINING - The Industrial Training project will create a current data bank of Industrial Training Trainees and Clients in order to produce The Industrial Training Monthly Reports and various other related reports. The capability to retrieve needed Industrial Training accounting information from the VCCS accounting data base will be created by interfacing with the accounting system. The Industrial Training System will replace clerical functions and primarily produce managerial output reports. This development effort will be in an area where EDP has not been used before. This system will be designed to process and store data on approximately 3,000 trainees yearly, who are trained by approximately 30 different clients in 30-40 Industrial Training Programs.

FINANCIAL ACCOUNTING - This system is designed to capture financial data relating to all fund sources available to the Virginia Community College System--state, federal, local and capital appropriations. This system is to encompass an automated general ledger, as well as revenue, expenditure, encumbrance, and budgetary control accounting, and financial reporting by fund sources to the various levels of users. It must interface with and process data from the Personnel/Payroll, Budget and Purchasing System. Being user controlled, the system is user oriented to provide accurate, timely and pertinent financial data so that management can efficiently utilize all available financial resources.

LOCAL FUNDS ACCOUNTING - This system will be designed to manage and monitor the local fund monies used by the colleges and monitored by the System Offices. The major requirements of both colleges and System Offices users would be satisfied by automating the existing manual methods. The four basic types of monies e.g. local board funds, student oriented funds, bookstore funds and federal funds will be captured and stored in a database for batch and on-line retrieval.

BUDGETING - This proposed system must have the capability to produce historical, current and projected information to meet requirements of the General Assembly, State agencies, State Board for Community Colleges, System Offices, and individual colleges. Major components of the

Budget System data base will be enrollments, staffing (faculty and support staff), faculty salaries (averages and actual), support staff (salaries and wages), expenditures (personnel services and other expenses), and revenues (by source of funds). The coding nomenclature and report formats of this system are to be designed to conform with the standard State program budget structure. This system will also include two budget cycles: the biennial to develop requests for State appropriations and annual to develop internal budgets for operating purposes. The proposed Budget System should interface with the Financial Accounting System, Personnel/Payroll System and the Student Information System in order to generate information as required.

PURCHASING - This system will monitor the processing of purchase requisitions and purchase orders throughout the request, bid and approval cycle. It will provide the the very important origin point of much of the System's financial information base, and it is to interface directly with the Financial Accounting System.

EQUIPMENT INVENTORY - This system will contain a complete listing of the equipment and furniture owned by a college, including pertinent descriptive data, cost, source of funding, acquisition date and a unique I.D. number. This system will also include automotive equipment by total cost and by make, model, and serial number. This information would be used to assist in the scheduled replacement of equipment and furniture as well as to effect a more controlled purchase of such items.

SUPPLIES INVENTORY - This system would assist the college in the acquisition, maintenance and disposition of expendable goods and services. Information can be generated through this system to assist in managing the supply of on-hand expendable goods and for making goods available for use in an equitable and efficient manner.

PERSONNEL - This system will contain personnel administration data and information on all members of the faculty, administration and support staff. This system would include payroll records as well as personal information on employees to assist those designated administrators having personnel administration responsibilities with the management of their staffs.

Applicant Processing - This subsystem will be designated to encompass a bank of applicants including personal resumes and application data. This subsystem would record the specific fields of specialization of individual applicants so that an automated inquiry can be made of the data base in order to quickly secure and refer qualified applicants for faculty and classified positions as vacancies occur.

Personnel Management - This subsystem is used to prepare the necessary paperwork for bringing a new employee on board and administering him while a State employee. This subsystem includes new hire and transfer of persons into the authorized positions. It would include the individual personnel data on all such individuals hired and it would provide for reinstatement or reemployment of former State employees. This subsystem also would provide for promotion and demotion, termination and retirement, and going into a non-pay status or a suspension. It would include merit increases for classified personnel and faculty salary adjustments. All of the Personnel Management Subsystem functions mentioned above which affect the pay status of the individual would interface with the Payroll Management Subsystem and also with the Financial Accounting system, which is emphasized to show that the Financial Accounting System itself must be automatically updated as money is obligated for personnel matters.

Organization and Position Management - This subsystem is designed to control for organizational management purposed for those positions which are established within the college, both classified and faculty. This subsystem would record new position requests, and justification, the status whether filled or unfilled positions, and expiration dates of positions with restricted longevity. In addition, this subsystem would also record the funding data associated with each position. Organization charts would be produced to show the detail organization by position of college activities such as divisions or the various staff offices. In such a printout, positions reflecting the college organization, the budget data, as well as the incumbent's name, if filled, and reflection of vacancy, if unfilled, would be produced. In addition, numerical listings of positions in position number order would be produced as required for management purposes. The position management component would allow for position reallocation and change.

Course/Schedule Interface - This subsystem would provide an automated means of capturing the teaching load and overload, if any, of faculty members in order that there can be adjustments as necessary in the normal teaching load of faculty and the identification of residual end-of-year overloads for pay. This subsystem can also be effectively utilized to schedule summer faculty in order to assure that the expected courses are properly planned and covered by summer contracts.

Leave Management - This subsystem is designed to provide an automated balance of an individual's sick, annual, if authorized, and compensatory leave with updates as the individual utilizes leave and reduces his balance, in order that the automated system maintains a current year-to-date leave balance in all categories. The maintenance of necessary edits to insure that personnel who become deficit in a leave balance are automatically flagged, such individuals would be placed in a leave without pay status and rejected for applicable payrolls.

Education/Training Development - This subsystem would include the needs of the individual employees in order to be fully qualified for a particular job or a particular faculty rank. Each individual could then be compared to the requirements of his position or his requirements for promotion. This would allow for identification of requirements for additional training or education. Additionally, this subsystem could produce career paths and necessary educational pursuits for a specific career path to enable upward mobility of our employees.

PAYROLL - This system provides a process whereby employees, both classified and faculty, are efficiently paid on a semi-monthly, bi-weekly or quarterly basis, as required. The system must be sufficiently flexible to adapt the changing needs of the administration of benefits and deductions. It will include the automated preparation of payroll printouts which would provide gross salary computations, deduct any mandatory or voluntary payroll deductions, and provide a net pay for all personnel. It would provide rollup of quarter-to-date and year-to-date salary amounts for accounting purposes. The automation of the present hourly payroll would be accomplished by computerization of the basic computations on the payroll which are currently done manually. This would involve input of hours worked and any salary changes, and thereafter, automatically computing the necessary deductions and the net pay.

COMMUNITY EDUCATION - This system utilizes a data base which includes data elements about the services being offered to students and the participation of students in these services. This system comprises two components: a Continuing Education Unit Subsystem and Public Service Activities Subsystem.

Continuing Education Unit - This subsystem supports the management of course and program offerings in which a CEU award can be earned upon successful completion. These offerings include conference,

institutes, short course, workshops, seminars and special training programs. Minimal biographic and demographic information is collected and maintained on students enrolling in these offerings.

Public Service Activities - This subsystem is used to manage public service activities which can be defined as those offerings not carrying academic credit or continuing education unit credit. These offerings include educational, recreational and social opportunities on campus or off campus in a manner to capitalize on an institution's particular competencies and resources.

COURSE/SCHEDULE MANAGEMENT SYSTEM - This system encompasses a series of subsystems which are used to manage courses. The course dictionary and the course schedule data base must have direct linkage to the Student Information System, the Facilities Inventory System and Personnel System and Payroll System.

Course Dictionary - This subsystem is the cornerstone of the Course/Schedule Management System. The course dictionary contains essential course data such as approved courses, prefix and number; short and long course titles; class credits; class hours; laboratory descriptors; and other pertinent course data. Institutional course dictionaries would have to be matched periodically with the VCCS Course Dictionary for compatibility.

Course Management - This subsystem provides the necessary WHERE-WHO-WHEN in the course schedule building process. Using a combination of student, facilities, faculty and course dictionary data elements, this subsystem provides the allocation of faculty, facilities and course resources to meet student demand and curricular requirements. The utilization of resources involves the distribution of rooms according to time avilabilty and course requirements, and the assignment of faculty to courses on the basis of expertise and subject area. Adjustments to the allocation and distribution of resources and the control of courses and sections in the schedule building and adjustment activities are managed throught this subsystem.

Quarterly Class Schedule - This subsystem is used to manage a time oriented inventory of course information, both past and present. This subsystem provides a current schedule for printing and publishing purposes as well as a historical record of past courses with essential data to provide insight of past

requirements. The historical information can be used to determine the last time when a particular course was offered and whether there is enough justification to offer it in future schedules being developed.

Faculty Management - This system is designed to provide instructional workload data on individual faculty and to manage faculty assignments. Activities include the listing and verification of instructional assignments, including the assignment of release time and overload conditions.

FACILITIES INVENTORY - This system is designed to encompass all pertinent data about facilities regarding room size, characteristics, type of use, condition, maintenance history and location. This system would enable the Virginia Community College System to determine existing facility resources as well as assist in identifying additional facility requirements.

FACILITIES UTILIZATION - This system is designed to assist the college in achieving an improved utilization of space through more economical space planning. This system must be linked with the Course/Schedule Management System and the Facilites Inventory System in order to generate information necessary to assist the college in the management of existing facility space.

LEARNING RESOURCES - The center of this system is the bibliographic controlled data base which contains complete records for all media items (books, periodicals, tapes, films, etc.). This data base contains all data elements needed to manage acquisitions cataloging, circulation and serials control of media items.

Acquisitions - This subsystem would handle material orders and provide information such as status, vendor, price, dates, etc. Title searches in the current public catalog would indicate when a particular title is not owned currently but was on order. This subsystem would be tied closely to the Financial Accounting System.

Cataloging - This subsystem would supply all bibliographic information about an item and where it is located. This source would be the public catalog, the point where a user would go first to check whether an item is owned by the college. This cataloging unit will be linked eventually to a national cataloging data base such as the Ohio College Library Center/Southeastern Library Network (OCLC/SOLINET). Another logical use of this subsystem would be for inventory control within the colleges and for an interlibrary link with other postsecondary education institutions and other agency library networks.

Circulation - This subsystem would control the whereabouts of all materials taken from the college Learning Resource Center. Items already in circulation could be flagged as needed for individuals wishing to check them out when the respective items were returned. Key by-products of this subsystem include overdue notices to students and statistical reports on borrowing patterns on the collection.

Serials Control - This subsystem would be used to control the daily receiving and check-in of periodicals and produce the union serials list for the college. It could also be used to keep track of periodicals which were not received and to produce claim notices to be mailed to the subscription service.

RESEARCH AND PLANNING SYSTEM AREAS

THE VIRGINIA INFORMATION EXCHANGE PROCEDURES - The Virginia Information Exchange Procedure (VAIEP) System has been implemented using software developed by the National Center for Higher Education Management Systems. The VAIEP System has student data, personnel data, accounting crossover and data management modules. This system's primary files include the student enrollment, payroll master and voucher register. The reports which are produced annually include (1) program and disciple unit costs, (2) faculty productivity ratios, (3) direct costs, (4) average salaries, (5) types of faculty, (6) indirect costs, (7) fund sources, and (8) courseload and workload matrices. This system and reporting procedures are mandated by the State Council for Higher Education.

STUDENT AND ENROLLMENT CHARACTERISTICS -Utilizing VCCS admissions and registration census date data this system would produce the enrollment characteristics table of the VCCS Student Enrollment Booklet and the "first-time student profile data summaries". Data in the enrollment booklet are represented by full-time and part-time status; freshman and sophomore; sex; race; program type; curriculum; first-time, transfer, or returning; day or evening; in state or our-of-state resident; headcount; full-time equivalent students; and on-campus or off-campus locations. Student profile data include student's goals, demographic information, and family/individual income data. The colleges, independently, produce other student enrollment profiles through this system.

ENROLLMENT PROJECTIONS - This system will support the development of the colleges and VCCS enrollment projection process. Output from this system will include audit reports for the SCHEV Forms 2-B and L-1. This system will also

provide summary data from these reports. Another report entails the computation of ratios and summary data for the SCHEV Form 2-BS.

BUDGET PLANNING - This system is proposed to assist the colleges and System Offices in developing planning models to assess the effects of changing resource costs. A cost simulation model could be used to calculate program cost information and implied source requirements. Such a model would also provide the colleges and System Offices with various alternatives for utilizing a limited set of resources.

FACULTY PRODUCTIVITY ANALYSIS - A Productivity Analysis System (PAS) has been designed by the staff at New River Community College and is currently being implemented at several Virginia Community Colleges. This system is an alternative to the traditional costing models. It provides a means of identifying and analyzing faculty workload and of producing efficiency data on each organizational unit, using staffing ratios approved by the State Council of Higher Education and the State Budget and Planning Office. Because the major proportion of a colleges' instructional budget is devoted to personnel, the PAS System can and has contributed substantially to administrative assessment and decision-making regarding the management of instruction.

INSTITUTIONAL RESOURCES ANALYSIS - The colleges and the System Offices have a critical need for a cyclical planning system to monitor and guide the colleges and System Offices in their use of all resources. Such planning entails goals inventories, commmunity and/or business needs studies, personnel files that adequately describe faculty in administrative talents, evaluation of the effectiveness and efficiency with which resources are utilized in the instructional process, student evaluation of program experiences and faculty-administrator evaluation of the use of facilities and budgets. This system area would encompass all short and long-range planning efforts.

ANALYTICAL REPORTING - Decision-makers at the colleges and the System Offices have need of analytical reports to support the rationality of their management judgements. Such studies involve college and VCCS task group activities and utilize special research design techniques. The studies may be short or lengthy and vary from a succinct assessment of student financial aid to the development of a new noncurricular student classification system for previously unclassified students. An example of such analytical reporting involving both qualitative and quantitative data can be seen in the Research in the Virginia Community College System, 1976-77.

GRADUATE PLACEMENT AND FOLLOW-UP - This sytem will be designed to annually assess graduate transfers and job placement information. For each graduate this system will provide identification data, post-college activity data, and awards data. This system will be maintained by the colleges through an existing "G" (graduate) data subsystem component with key data elements from follow-up surveys to form individual placement records.

FACILITIES UTILIZATION ANALYSIS - The colleges and the System Offices are engaged in modifying and implementing the Facilities Utilization Analysis System, a product of SCHEV. This system, once implemented, will provide more complete data for evaluating current classroom and class laboratory utilization, together with data on other types of space used in instructional activities. The Facilities Utilization System will use data from the existing room inventory file as well as course related data from the census date enrollment files of the colleges. Information derived from the system will be used to develop utilization standards and to evaluate and support capital outlay budget requests.

STUDENT RETENTION - The VCCS Student Retention and Withdrawal System will:

1. Track students as they enter, leave and re-enter the colleges over a several quarter time span

2. Collect and assess information on students (reasons for persistence and withdrawal).

This information will be collected and maintained by the colleges using survey sampling techniques. Output reports would include colleges and VCCS persistence rates by full-time and part-time students, by entry goals and objectives, by curricular clusters and by each curriculum. Details regarding students' reasons for persisting or withdrawing would be presented in written reports.

FOUNDATION - The Foundation Subsystem will support the Foundation Offices in directing fund raising campaigns. There will be three modules: corporate, alumni and faculty/staff, which will generate mailing labels, maintain a donation record for each participant in the campaign and generate management reports to analyze and track the success of the campaign. The Foundation Subsystem will also provide for the accounting of disbursements from the Foundation funds.

Appendix B

ACADEMIC APPLICATIONS

Scope

The term "academic computing" is at best a reference point or general heading for a range of different uses to which computers may be put in the field of instruction. These uses lend themselves to such basic classifications as follows:

1. Instruction in data processing technology - computer programming, systems analysis, management of computer operations, and related studies.

2. Computer-managed instruction - the use of a computer-based test library and testing capability for individual student testing, evaluation, and specific prescription for further study. Also includes such items as processing of qualifying examinations, generation and maintenance of test banks, validation of test questions, and grading.

3. Problem solving - the use of a computer for its computational capacities, to set up and solve problems and equations in the natural, mathematical, and social sciences, and in applied fields such as business, economics and engineering.

4. Tutorial instruction - the use of the computer on an interactive basis to provide dialogue with the student, involving student response to posed statements or questions, drill and practice, and computer-generated evaluations and feedback. Involves techniques traditionally associated with computer-assisted instruction (CAI) and programmed instruction.

5. Simulation - the use of the computer to simulate conditions or situations in the various disciplines and fields of study and provide working computer-generated models for instructions. Examples of such simulation would include management problems with a number of interrelated variables, engineering

applications in construction or architecture, highway and traffic control, and scientific experiments not practical in the laboratory due to considerations of safety or instrumentation.

The first classification above, instruction in data processing technology, is unique in that it necessarily uses the technology for which it trains. The remaining classifications of academic computing are instructional alternatives for a range of disciplines, with common benefits as follows:

1. Swift and accurate retrieval and presentation of course materials.

2. Swift and accurate disposition of student response.

3. Learner control of materials and rate of presentation.

4. Active student involvement.

5. Potential for repetitive drill, self-testing.

6. Variable levels of application based on learner needs and interests.

These are the characteristics of effective delivery schedules. They emphasize learner-orientation, individualized instruction, and provide an extension of the instructor's time and attention. However, the learning process will be made more effective through academic computing only if these other conditions are also present:

1. Correlation of materials and intended learning objectives.

2. Correlation and compatibility with other elements of the instructional strategy for mutual reinforcement.

3. Effective presentation which responds to student need and enhances student interest and motivation.

4. Personal involvement and commitment of the instructor.

Some clue as to the greatest present potential for academic computing under these essential conditions may be found in the course of events nationally, as reflected in current publications. Natural science, mathematics, and computer science head the list of illustrative applications at four year colleges and universities, as reported in the NumRRO Academic Computing Directory. Applications in the

social sciences, economics, and behavioral sciences are not far behind. Business, engineering, and language training (including English reading and compsoition) are following at about half the rate of the leaders.

The list of illustrative applications as reported for community colleges has computer science (including data processing technology) and business close behind, with all others at a considerable distance or not represented. Specific activities and interests as reported by instructional divisions at Northern Virginia Community College in response to the 1978 survey reflect very closely this trend in major applications.

The January 1978 courseware catalog, published by Control Data Education Company for its present or potential "PLATO" subscribers, is heavily oriented to business, mathematics, the natural sciences (especially chemistry and physics), computer science, and the basic skills (English, mathematics and reading).

It can be reasonably assumed that the approximately 200 institutions of higher education listed in the Academic Computing Directory have moved first into areas with greatest prospects for benefit from academic computing. The conclusion may be drawn that there are many fields of learning where the structured, analytical approach inherent in academic computing can be useful as a primary or adjunct element of the existing learning strategy. It may be further concluded from the evidence that the most fertile fields for early application are those where the topical material is itself structured, usually involving a high order of logic and sets of rules and principles.

Academic computing can be put to good use in such fields in the full range of its potential--tutorial and drill, rule asserting, problem solving, simulation, testing--if materials and presentation are effective, motivating and responsive to both learning objectives and student interests.

It must also be observed that even in this potentially favorable environment, there are serious constraints or limitations which must be dealt with in planning for use of this instructional alternative.

1. Severe limit on present availability of courseware, and difficulty in relating commercially available courseware to instructional strategy.

2. Long lead times and expense of courseware and test development.

3. Limited number of faculty members trained in development.

4. Critical need for intensive faculty articulation and agreement in courseware development and application.

The constraints are interlocking and they tend to reflect the current state of the art as it exists generally in the colleges. They are not, however, insurmountable barriers to progress. They simply mean that academic computing is still largely in the development stage. For the immediate future, progress will be relatively slow and costly. Academic computing applications must be selective and directed to areas which (1) offer most immediate benefits and (2) lead toward further progress and expansion.

Goals

Development efforts must be responsive to college needs and priorities and must proceed within a set of finite college objectives as follows:

1. To produce significant gains in learning.

2. To extend instructional capacity and range.

3. To aid in introduction of students to the world of computers.

4. To improve the use of time and other resources.

5. To extend faculty capability for monitoring, measuring, and guiding student progress.

6. To improve faculty evaluation of teaching effectiveness.

These objectives must be pursued under a positive, active institutional commitment and those conditions which guide instruction itself--academic freedom and professionalism, privacy of the individual, governing legal restraints and requirements, ethics, and security.

Criteria

Attainment of the goals will depend upon attention to fundamental criteria for academic computing which take into account the evolving state of the computing art, the need for economy and discretion in the use of computing resources, and the nature of the instructional process itself:

1. Capacity to Accomodate All Classifications of Academic Computing - At the present time, academic computing at most community colleges is weighted heavily toward instruction in data processing technology. Computer assisted instruction, including tutorial and drill and practice, computer-managed instruction, and computer-supported instruction are all in use at several colleges--especially at the Alexandria Campus of Northern Virginia Community College in the TICCIT system. A simulation capability has also been implemented on TICCIT. If maximum benefit is to be gained, a comprehensive and flexible academic computing capability must be available at all campuses and adaptable to any of the classifications which can be developed and established as a viable instructional alternative.

2. High Degree of Interchangeability of Courseware and Software - It has been well established that development of courseware (instructional materials in computer-susceptible form) is extremely time-consuming and expensive. As is always the case with high set-up costs, cost effectiveness must come through extensive and recurring use. Development of effective and motivating courseware is also an art or skill which must be learned by faculty members and instructional technologists at very considerable committment of time and effort.

   The cost and difficulty of producing high quality courseware can be the limiting factor in deciding whether to pursue academic computing applications. It can be readily inferred from reports and presentations regarding TICCIT that the development of courseware has been and is a critical limiting factor in growth and progress. Faculty members, disciplines, divisions, campuses, and colleges which become involved in academic computing must expect and depend upon mutually developed courseware (and supporting software). Even more to the point, it may be most advantageous to acquire and use courseware developed commercially or at other institutions.

3. Ease of Courseware Creation, Authoring - To the extent that courseware is developed within colleges, it must be created in a context which provides the greatest ease and efficiency possible. This may involve central or coordinated creation of basic routines or exercises which can be applied in more than one discipline, whereby a foundation for the development of successive building blocks. It may

also involve use of computer-generated courseware. Courseware development must be subjected to the most efficient production methods possible.

4. Responsive to Faculty Course Development and Management - As previously discussed, academic computing is a useful, productive alternative only when applied as an extension of the instructor's own reach and compatible with other elements of the instructional strategy. It thus follows that the academic computing resource can be adapted to effective use by faculty members in development and management of courses.

5. Ease of Access - The advantages of academic computing are that it permits individualized student scheduling and frees the instructor from the more rigorous time constraints of the traditional classroom. Of perhaps even greater significance is the individualized or variable student level of use. In this regard, academic computing is considered to offer a valuable adjunct opportunity for remedial study or enrichment.

   Thus, it follows that the academic computing facility in its best and necessary context must be accessible to users on an unscheduled, random basis. The extent and location of available capacity and input devices is equally important. If academic computing is successful and accepted, there will be a growing demand for terminals (or other input-output devices) and for computing capacity. A facility which cannot keep up with quantitative and qualitative demands may fail to support learning objectives and faculty assignments, and discourage student initiative.

6. Interactivity - In the interactive mode, the participating student and the respondent computing facility are in a real-time dimension and there is no appreciable delay in the interchange. This may indeed be the great capacity in which academic computing can outdo the instructor, in staying with the student in a one-on-one situation. There is some utility in sending student exercises out to be processed and returned, as examinations and term papers have been traditionally. There is far greater merit in the direct and continuing interchange, and the interactive mode is highly desirable and of great value to many learning situations.

7. Distributed Processing - Distributed processing is a relatively new concept, or at least a relatively new term, and one whose potential is not yet fully realized. This is a concept in which the total

computing capability within and among colleges is distributed economically, but is fully accessible to all legitimate users. In the present state of academic computing at most community colleges, distributed processing is more a long range concept to be respected than an immediate commitment to be met. Even so, planning and resource acquisition must be geared to this evolutionary trend, since distributed processing offers remarkable benefits in terms of both economy and productivity.

(Budding elements of distributed processing are reflected in the communication of the IBM 3780 Remote Job Entry terminals at the colleges with the VCCS/VCU Computer Center. A more complete system might involve interactive terminals and an intermediate computer at the college level, storing some programs and processing some applications, while transmitting forward those of a larger magnitude.)

8. Modularity with Provision for Orderly Expansion - Academic computing, with the exception of instruction in data processing technology, is still in a primary stage. Other than data processing instruction, TICCIT is no doubt the largest coordinated application (or combination of applications) within the VCCS. It has been on an experimental basis until very recently, and a number of its applications are still undergoing development. Applications elsewhere in the colleges are for the most part on a local and limited or unstructured basis. Success and growth can be expected; the specific direction and rate cannot be predicted with absolute accuracy.

9. Adaptability to Advances in the State of the Art - It can be expected that courseware, software, and hardware will constantly become obsolete through advances in the state of the art in educational technology. This is reasonable and in most instances desirable, because it means progress. It is also expensive and difficult to cope with, especially where there is a major fixed investment in hardware with courseware and software irrevocably tied to it. Obvious needs are (1) keeping equipment as flexible and adaptable as possible consistent with operating requirements, and (2) avoiding where ever possible mutual inter-dependency between courseware and hardware, to limit obsolescence of courseware as a result of hardware changes.

10. Standardized Resources - As previously discussed, courseware (and related software) must be as standardized as possible to be affordable throughout

the VCCS. To the extent that hardware must have the capacity to carry standard courseware, it must be standardized as well. In the long run, also, the evolving concept of distributed processing can best be served by an array of technically compatible processing units, input-output devices, and communications or transfer links.

11. Motivational and Responsive - In the final analysis, academic computing is no more than a tool of instruction, for use by teacher and student in the learning process. Whatever its specific technical characteristics, it is absolutely essential that it motivate the student and facilitate the learning process in a given situation better than any other available and affordable tool. It is equally essential that it be responsive to the instructor's objective and extend the instructor's reach.

Priorities for Development

1. Data Processing Technology Of first priority among the classifications listed in Chapter 8, with first claim on planned academic computing resources, is instruction in data processing technology. This is one of the primary occupational-technical curricula in some of the colleges which offers support of one of the major employment fields in the community. At present, student programs at colleges not having Hewlett-Packard equipment are processed through remote job entry punch card-fed terminals on a batch basis to the VCU/VCCS central computer in Richmond. The batch method of developing programs using punch cards is rapidly becoming obsolete in the industry, and is being replaced by use of the interactive terminal.

   It is essential that college instruction in programming languages have an interactive computing facility as soon as possible because (1) it responds to changes in the industry and thus updates job preparation, (2) it greatly improves instruction by virtue of immediate response as opposed to a delay in turn-around and the inefficiencies of punch card batch trial and error. A move to an academic computing capability which is "state of the art" for this field is absolutely essential as a first priority.

2. Other classifications of computing resources required for the necessary upgrading of instruction in data processing must incorporate functional specifications

suitable and adequate to application of the remaining classifications of academic computing: computer-managed instruction, problem solving, tutorial, drill and practice, and simulation. Thus, resources acquired for this priority purpose will provide a capability or base for orderly expansion into the other classifications as they are developed or improved at the colleges. A number of projects or applications are now being proposed which can be advanced through coordinated faculty development efforts.

Assuming the availability of adequate hardware and software, development of courseware must be developed by college faculty. This leads to a self-enforcing set of priorities in which the simpler applications, such as problem solving, will be developed and in general use well ahead of the much more complex tutorial instruction and simulation. Within this overall context, each developmental proposal must be considered on its own merits as events progress, taking into account the following:

1. Faculty interest and expertise.
2. Relevance and scope of applicability.
3. Logical progression and expansion.
4. Availability of uncommitted resources.
5. Ease of application and immediacy of benefits.
6. Relationship to prior or existing efforts and applications.
7. Cost-benefit ratios.

As a general guideline, early attention and priority should be afforded proposals which are directed to areas most readily and widely susceptible to the uses and benefits of academic computing. For the most part, these will be in the highly structured disciplines, involving quantitative expressions and early opportunities for use in problem solving and computer-managed instruction.

Appendix C

NETWORK MANDATORIES

In order to proceed with the development of the distributed computing network it is necessary to state the system mandatories based on existing capabilities and anticipated new requirements.

1. Supports ANSI COBOL computer programs;
2. Multi-programming environment (running several programs simultaneously);
3. Supports virtual storage;
4. Accepts VSAM or similar indexed file structure;
5. Provides batch spooling environment;
6. Provides for remote entry programs which may be in any of several different languages;
7. Capable of operating as a Remote Job Entry (RJE) Station;
8. Capable of operating a DBMS (Data Base Management System);
9. Capable of operating a DBDCS (Data Base Data Communication System);
10. Capable of supporting a high volume of terminals in a student environment;
11. Supports communications with bisynchronous terminals such as 3278's to include such features as function keys, full screen input-output, fully addressable cursor, modified data keys and local control printkey;
12. Supports TTY - like (teletype) terminals;
13. Supports 1600 and higher bpi (bytes per inch) nine track EBCDIC (extended binary coded decimal interchange code) tape drives;

14. Supports minimum real storage of 512K bytes;

15. Supports minimum virtual storage of one mega-byte;

16. Supports the following compilers:
    FORTRAN, COBOL, PL/1, RPGII, ASSEMBLER

17. Supports the following software packages:
    IMSL, BASIC, SPSS, SAS79, BMDP, PASCAL

18. Supports the following Autobatch Facilities:
    WATIV, WATBOL, ASSIST, PL/C

19. Supports an interactive instructional system or comparable CAI package;

20. Capable of operating a text editing system.

21. Supports programming aids for application development.

22. Supports networking for the purpose of resource sharing.

23. Provides supporting software and aids to assist in establishing and maintaining the network from one or more locations.

Appendix D

PROJECT TEAM CONCEPT

The following is recommended to provide appropriate control and balance for systems development activities in the VCCS.

1. COMPUTING SERVICES PLANNING COMMITTEE - The "Final" recommending body regarding project development.

2. USER PROJECT TEAM - A group of users having the responsibility for contributing to the design specifications document, and reviewing developmental project team work as representatives of the user community.

3. TECHNICAL REVIEW COMMITTEE - Group composed of data processing staff and, if required, appropriate users to provide recommendations on technical matters.

4. DEVELOPMENTAL PROJECT TEAM - Group consisting of a senior analyst to act as project leader for the duration of the project and appropriate support staff as required by the nature or phase of the project.

PROJECT REVIEW STRUCTURE

COMPUTING SERVICES PLANNING COMMITTEE

1. DEFINITION

The Computing Services Planning Committee is constituted to provide "final" direction, approval, and the settling of differences for major project and developmental efforts in Data Processing. The Committee represents a forum of high-level peers for a continuing review and assessment of specific divisional requirements considered within the framework of the "total" VCCS needs. The Computing Services Planning Committee thereby provides a means for sorting all the needs in their proper perspective with regard to the overall system objectives.

2. STAFFING

The Computing Services Planning Committee membership is appointed by the Chancellor and includes the following:

a) Chairman - Director of Data Services.

b) Department Head (2) - Two operating heads of functional areas served by VCCS (Planning and Evaluation Director and Budget Director).

c) User Managment (5) - Members from institutions of the Virginia Community College System.

Any Planning Committee member may invite non-permanent members to attend specific meetings to make presentations or to observe. Guests may participate only in those instances where they are directly involved with the item upon which the Planning Committee action is to be taken, or when asked by the Chairman to participate in the deliberations. They in no case have voting privileges.

3. RESPONSIBILITES

The following Computing Services Planning Committee responsibilites are related to major project development:

a) To facilitate and coordinate project efforts that cross organizational boundaries and to resolve issues of inter-divisional resource allocation that may arise among different groups contending for the limited Data Services resources.

b) To recommend the establishment of application task forces to study specific subsystem requirements including the selection of an appropriate User Project Team for major projects.

c) To review and evaluate all major VCCS projects to ensure that the systems are mutually supportive and directed toward the attainment of VCCS objectives, and to set priorities such that the limited computer resource serves best the "VCCS as a whole".

d) To help resolve differences between the Developmental Project Team and the User Project Team.

e) To review all project phases for approval, conditional approval, rejection or tabling.

4. PROTOCOL

The protocol for the Committee is according to the rules of parlimentary procedure. The Committee must approve the individual phase end-document for all major projects before beginning the next phase. Data Services provides a criteria for approval with an associated check-list for each project phase.

In making a disposition on each agenda item, the following represent the "official" actions that will normally be taken by the Computing Services Planning Committee.

a) "APPROVE" - The action represents the "final" authority to proceed with the next phase of development, or whatever other action that is implicit with Planning Committee approval.

b) "CONDITIONAL APPROVE" - This action will result in an "approved" status ONLY after the stated "conditions" are removed: Data Services management must follow through for compliance and coordinate any required action with the appropriate groups for the given conditions.

c) "REJECT" - This action will automatically terminate any further effort or prevent the acceptance of any new item under consideration; the reason for rejection MUST be stated. (Note that there can be an appeal to a higher authority such as the Council of Presidents or the Chancellor but this appeal must be requested through the Computing Services Planning Committee.)

d) "TABLE" - This action is taken upon agenda items which the Chairman did not have time to consider or to postpone the action until the next meeting ("tabled" items will always appear as the first order of business during the next meeting of the Computing Services Planning Committee.)

In addition to the formal actions described above, each member of the Computing Services Planning Committee has the right to "WITHDRAW" the item from further discussion so as to preclude the possibility of a formal "REJECTION".

USER PROJECT TEAM

1. DEFINITION

The User Project Team is a recommending body for continuing review and evaluation of the project. It is through this group that user needs are represented. With this goes the ultimate responsibility for insuring that the proposed system satisfies user requirements.

2. STAFFING

The User Project Team will be composed of five members from the user area and the Developmental Project Team Leader. The Computing Services Planning Committee will designate the user representatives, designating one as the Chairperson. The Developmental Project Team Leader will be recommended by the VCCS Computing Services Planning Committee. Every effort should be made to staff the Team with users from varying levels of involvement with the proposed system. In addition, care should be taken to balance the Team between large, multi-campus colleges, and smaller colleges, as well as between the colleges and VCCS System Offices.

3. RESPONSIBILITIES

The primary tasks of the User Project Team are:

a) To identify and communicate user needs to the Developmental Project Team

b) To review the Developmental Project Team's phase end-document to ensure that the system development conforms to prescribed VCCS standards and procedures.

c) To ensure that the proposed system meets user requirements.

d) To foster communication between the user organization and Data Services.

e) To provide consulting services to the Developmental Project Team in relation to how phase tasks and plans apply to user needs.

f) To review all requests for modification to the system for which the User Project Team is responsible.

g) To appoint Project Team Task forces as necessary to complete short term projects.

h) To review phase work plans.

4. PROTOCOL

User Project Team

a) The Chairperson will schedule and convene all meetings.

b) The five members appointed by the Computing Services Planning Committee will each have one vote in making decisions.

c) A simple majority is required to reach a decision.

d) The Developmental Project Leader serves as a technical advisor in Data Processing Systems Analysis, and User related problems. The developmental Project Leader does not vote on User Project Team issues.

e) The Developmental Project Leader presents all phase plans, tasks and documents to the User Project Team for their review and recommendation.

Outside of the User Project Team

f) When the User Project Team is in opposition to the Developmental Project Team's plans or end-document, the Team will draft a report for the Computing Services Planning Committee citing their objections, and offering their recommendations. The Computing Servives Planning Committee will make final decisions in these instances.

g) The User Project Team will work with the entire user community as necessary to meet their information needs.

DEVELOPMENTAL PROJECT TEAM

1. DEFINITION

The Developmental Project Team shall be the group which receives the project initiation document from the Computing Services Planning Committee, through the User Project Team, and performs all tasks related to the definition, development, and implementation of a project.

2. STAFFING

Developmental Project Team members are determined by VCCS Data Services and the colleges and shall consist of:

a) A senior analyst to serve as Developmental Project Team Leader for the duration of the project.

b) Other staff members including junior analyst, programmers and other staff members as required by the phase of a project.

3. RESPONSIBILITIES

The primary responsibility for the Developmental Project Team is to perform all tasks necessary to fulfill the charges of the Computing Services Planning Committee for each phase of a project.

The specific functions of the Developmental Project Team are:

a) To determine activities appropriate to each phase of a project.

b) To develop a work plan for each phase.

c) To conduct defined activities.

d) To document the results of each activity.

e) To maintain a detailed project file.

f) To coordinate project problem definitions and resolutions.

g) To obtain User Project Team sign-offs and management approvals.

h) To produce the end-documents of each phase.

4. PROTOCOL

a) The Developmental Project Team shall adhere to the guidelines and procedures of SDM/70 throughout the development process and shall prepare appropriate documentation in accordance with that methodology.

b) The Project Leader shall be responsible for coordinating the efforts of the Developmental Project Team with the User Project Team by contacting the Chairperson.

c) When appropriate, the Project Leader shall request the aid of members of the User Project Team by contacting the Chairperson.

d) The Developmental Project Team shall confer with the User Project Team in establishing direction and resolving user-related problems. Any differences of opinion which cannot be resolved by the two bodies shall be resolved by Computing Services Planning Committee.

e) The Developmental Project Team shall submit all work to the Technical Review Group for technical review, and to the User Project Team for conceptual review. The work shall then be submitted with recommendations, if any, to the Computing Services Planning Committee for final approval.

TECHNICAL REVIEW GROUP

1. DEFINITION

The Technical Review Group will be an ongoing internal body within VCCS, providing assistance for those products that have technical data processing implications. The main work of the Technical Review Group will be to assist with the System Design Objectives, System External Specifications, System Internal Specifications and Program Development phases of the project. However, the Group will continue to informally advise from the beginning of the project through implementation. For minor development or enhancement efforts, the Manager of Systems Development has the option of calling upon the Technical Review Group for providing recommendations on specific projects as necessary.

2. STAFFING

The Manager of Systems Development selects the Chairperson and other Data Processing personnel to serve as the Technical Review Group on a rotating basis. In addition, the Manager of Systems Development may request assignment of one or two technical representatives from the Colleges if there appears to be sufficient impact upon college data processing resources. Membership in the Technical Review Group will vary depending on the phase being reviewed, but will generally draw upon the following:

a) Quality Assurance Manager - Chairperson

b, Project Leaders

c) Representatives from Systems and Programming

d) College Representative(s)

e) Representative from Operations Support

f) Representative from User Services

g) Representative from Technical Support

3. RESPONSIBILITIES:

The Chairperson is responsible for the administrative activities of the Technical Review Group. These are in addition to the same responsibilities as the other members. Each member is responsible for reviewing and evaluating technical documents submitted by the Developmental Project Team as follows:

a) To ensure that system development efforts for the Virginia Community College System adhere to prescribed standards and procedures.

b) To evaluate the technical design of project phase tasks and present a report on their evaluation to the Development Project Team Leader.

c) To provide technical advice on design criteria and inspect major program code structure.

d) To act as a "technical advisory" body to the Developmental Project Team.

e) To conduct impartial reviews of the phase end documents to ensure that the system is incorporating accepted and proven design practices.

f) To participate in a "structured walk thru" of major program code before any testing is initiated.

4. PROTOCOL:

a) The Developmental Project Team Leader will contact the Technical Review Group Chairperson whenever the group's services are needed by the Team.

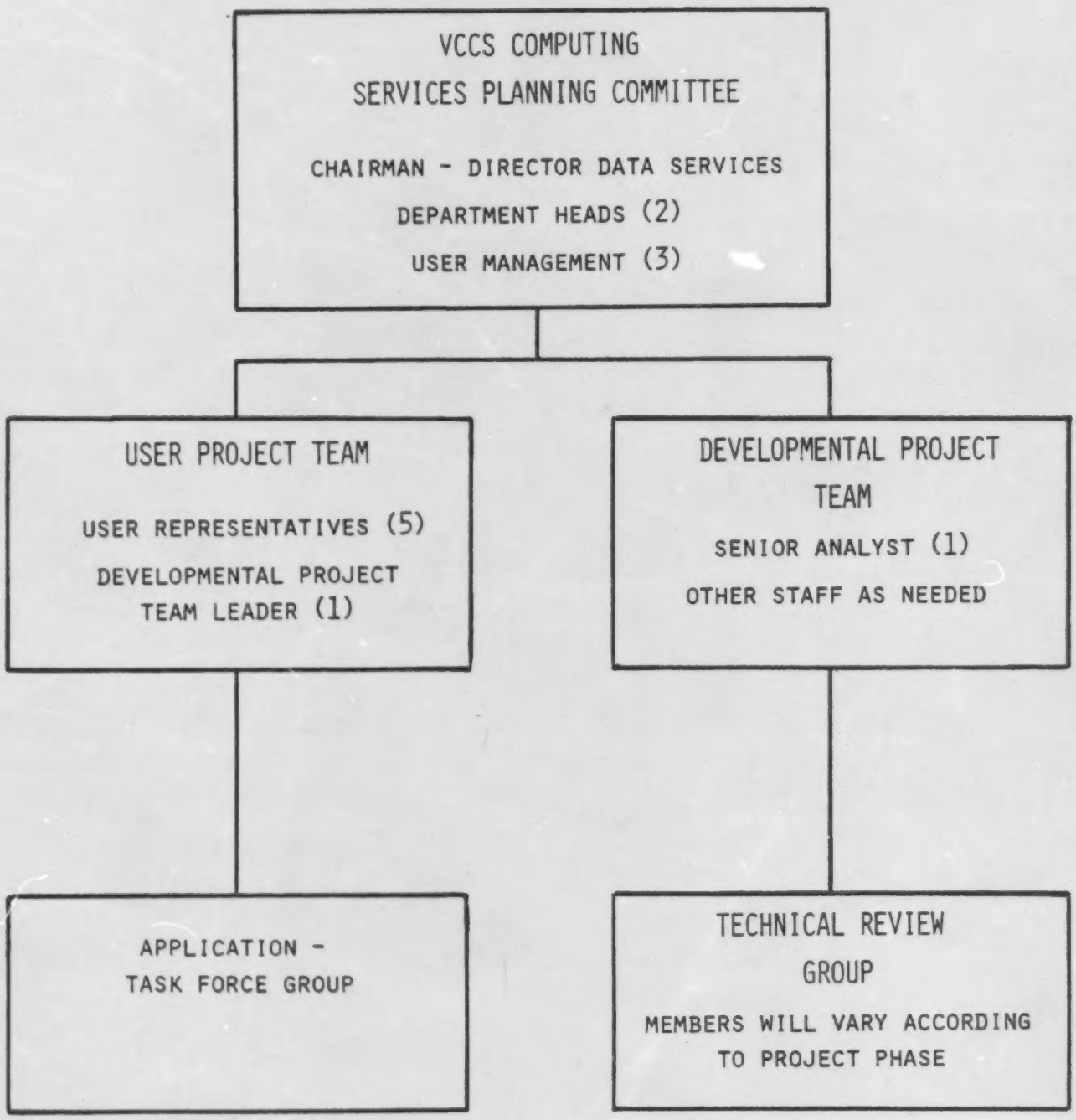
b) The Technical Review Group Chairperson reserves the right to convene the Technical Review Group as needed.

c) In the event that any differences between the Developmental Project Team and Technical Review Group cannot be resolved, the Manager of Systems Development will make the final decision.

d) Technical Review Group recommendations should be a consensus of all individual Technical Review Group member recommendations. In the event that differences among Technical Review Group members cannot be resolved by the Technical Review Group Chairperson, the Manager of Systems Development will make the final decision.

e) It should be noted that Technical Review Group can only make non-binding recommendations to the Developmental Project Team and it does not have any approval or rejection authority. The ultimate decision to accept or reject any Technical Review Group recommendations rests with the Manager of Systems Development.

PROJECT TEAM CONCEPT



Appendix E

SERVICE REQUEST PROCEDURE

PURPOSE — To provide uniform standards and procedures for the development of application systems using concepts and guidelines as delineated in SDM/70.

SCOPE — Covers all major requests for new information systems or enhancements to exising systems.

RESPONSIBILITY — All VCCS Colleges and System Offices Departments.

1.	Originator	Initiates Job Request/Trouble Report for new or enhanced system.
2.	Data Services	Conducts a preliminary analysis of the Job Request/Trouble Report and produces administrative support for the duration of the project.
3.	Developmental Project Team	Performs necessary phase tasks to produce a system that will satisfy user needs.
4.	User Project Team	Confers with Developmental Project Team and signs off on each phase of the proposed system as meeting user requirements.
5.	Computing Services Planning Committee	Reviews Job Request/Trouble Report. Staffs a User Project Team. Approves phase end-documents.
6.	VCCS Executive Administration	Gives final approval for all major activities.

PROCEDURES

1.	Originator	Develops a general description of need. Completes pertinent items of Job Request/ Trouble Report according to SMG procedure and transmits request to Data Services.
2.	Data Services	Reviews request for completeness. Conducts a preliminary analysis of the request and presents major requests to Computing Services Planning Committee.
3.	Computing Services Planning Committee	Approves, conditionally approves, rejects, or tables the request. Returns request to Data Services for development or refinement of scope.
4.	Data Services	Conducts in-depth analysis of request. Presents Project Initiation Document to Computing Services Planning Committee.
5.	Computing Services Planning Committee	Evaluates Project Initiation Document. Determines whether the proposed project is in accord with the Master Plan. Signs off on the Project Initiation Document by attaching necessary signatures and transmits this to the VCCS Executive Administration.
6.	VCCS Executive Administration	Approves, conditionally approves, rejects or tables The Project Initiation Document. Returns document to Computing Services Planning Committee with commitment to proceed with the next phase.
7.	Computing Services Planning Committee	Selects a User Project Team, transmits Project Initiation Document, and requests milestone date for completion of next phase.
8.	Data Services	Appoints a Developmental Project Team.
9.	Project Leader /User Project Team	Reviews phase end-document and sets a preliminary date for completion of the next phase; transmits milestone date to the Computing Services Planning Committee.
10.	Computing Services Planning Committee	Approves or rejects project phase milestone date.

11.	Developmental Project Team	Completes preliminary phase tasks. Schedules meetings with the User Project Team to ensure user satisfaction.
12.	User Project Team	Reviews all work and documentation produced by the Developmental Project Team.
13.	Developmental Project Team	Produces a phase end-document.
14.	Data Services	Performs a critical analysis of the phase end-document and recommendation. Provides SDM/70 criteria for phase approval.
15.	User Project Team	Approves phase end-document with or without exception. Conveys concerns, if any, with phase end-document to to Computing Services Planning Committee by attaching written recommendations to the end-document. recommendations to the end-document.
16.	Computing Services Planning Committee	Approves, conditionally approves, rejects, or tables end-document for the phase. Arbitrates differences of opinions, if required. Submits document to VCCS Executive Administration.
17.	VCCS Executive Administration	Approves, conditionally approves, rejects or tables the phase end-document. If approved, authorizes Computing Services Planning Committee to accept the document and make the commitment for the next phase in the methodology.
18.	Computing Services Planning Committee	Apprises the User Project Team and the Developmental Project Team of the decision of the VCCS Executive Administration. If approved, provides the Developmental Project Team and the User Project Team with the go-ahead for the next phase. The approval flow as described in steps 16 through 30, is then repeated for each of the remaining phases outlined in SDM/70.

Appendix F

APPLICATIONS CURRENTLY DEVELOPED

IBM APPLICATIONS

VCCS SYSTEM OFFICES (DATA SERVICES)
Financial Accounting
Purchasing
Financial Aid
Graduates
Payroll
Physical Inventory
Special Training
Student Enrollment (AKT)
Student Enrollment Booklet
Student Information Package
Reference & Archives
Unduplicated Student Enrollment Booklet
Va. Information Exchange Package
Voc. Ed. Data System
Admissions
Address Label Printing
Student Profile

New River Community College
Productivity Analysis Sys.
LRC Bibliographic System
Continuing Education Roster System
Continuing Education Address System File
LRC Borrowers System
Advisement System
History File System
Faculty Information System

Northern Virginia Community College
Student Information System
- Admissions
- Registration
- Grading
- Student Obligations
- Student Finances
- Student Record-Folder
- Graduation

Course/Schedule Management
- Course Dictionary
- Course/Schedule Management
- Quarterly Class Schedule

Facilities Management

Facilities Inventory
Facilities Utilization
Library Circulation
Continuing Education System
Inventory System

John Tyler Community College

Bookstore Ordering
Developmental Studies Test Scores
Master Student Mailing List
CEU Permanent Records
Inhouse Class Rolls

Virginia Western Community College

Graduate Follow-up
Special Services
Student Evaluation of Faculty
Beginning Freshman 'Alert' System

Colleges with HEWLETT-PACKARD computers

Student Information System
a. Grade Reporting Subsystem
b. Financial Aid Subsystem
c. Student Accounting Subsystem
d. Veterns Subsystem
e. Student History Subsystem
f. Graduate Candidate Subsystem
g. Alumni Subsystem
Local Funds Accounting System
Purchasing & Receiving System
Community Services System
Computer Utilization System
Mass Mailing System
Facilities & Equipment System
Guidance Information System
Audio Visual Catalog System
M & O Budget System
Test Scoring & Survey Analysis
Bookstore Accounting System
Institutional Research Support
Academic Computing
a. Date Processing Technology
b. CAI/CMI/CBI
c. Graphics
Software Maintenance

Central Virginia Community College

Student Services Support
Faculty Evaluation System
Instructional Cost Analysis
Personnel Accounting System
Library Circulation System
Employment Applications System
High School Survey System

COLLEGE	MAKE/MODEL	VENDOR	ITEM NAME	QUANTITY
Blue Ridge	Mits Altair 8800	IBM	Computer	1
	2502	IBM	Reader	1
	3521	IBM	Punch	1
	3776-2	IBM	Terminal	5
	129	IBM	Data Entry	1
	029	IBM	Data Entry	3
Central Va.	HP 3000	HP	Computer	
	2894	HP	Reader	1
	2894	HP	Punch	1
	3000	HP	Terminal	24
	029	IBM	Data Entry	2
	HP7979E	HP	Tape Drive	1
	HP7920	HP	Disk Drive	1
	HP7925	HP	Disk Drive	1
Dabney S. Lancaster	DATA 100		Terminal	2
	129	IBM	Data Entry	1
	029	IBM	Data Entry	1
Danville	3501	IBM	Reader	1
	3521	IBM	Punch	1
	3776	IBM	RJE Terminal	2
	3742	Dual	Data Entry	6
	029	IBM	Data Entry	1
Eastern Shore	DATA 100		RJE Terminal	1
	129	IBM	Data Entry	1
Germanna	DATA 100		RJE Terminal	1
	129	IBM	Data Entry	1
J. Sarg. Reynolds	HP 3000	HP	Computer	1
	HP 7920	HP	Disk Drive	2
	7925	HP	Disk Drive	1
	HP 7970	HP	Tape Drive	1
	2617	HP	Line Printer	1
	2635	HP	Hard Copy Printer	3
	2893A	HP	Reader	
	2640B	HP	Control Console	1
	2640B	HP	CRT	5
	2645A	HP	CRT	10
	2621A	HP	CRT	1
	3780	IBM	RJE Terminal	1
	3777	IBM	RJE Terminal	1
	DATA 100		RJE Terminal	1
	TCI 277		CRT	5
	G77c	Genesis	CRT	4
	3271	IBM	Control Unit	4

John Tyler	IBM S/3	IBM	Computer	1
	1442	IBM	Reader	1
	1442	IBM	Punch	1
	S/3	IBM	Terminal	2
	029	IBM	Data Entry	6
	129	IBM	Data Entry	1
	5444	IBM	Disk Drive	1
Lord Fairfax	3879	IBM	Reader	1
	3870	IBM	Terminal	2
	029	IBM	Data Entry	1
Mountain Empire	3780	IBM	RJE Terminal	2
	129	IBM	Data Entry	1
New River	2502	IBM	Reader	1
	3521	IBM	Punch	1
	3776	IBM	RJE Terminal	5
	3742	Dual	Data Entry	1
	029	IBM	Data Entry	4
	129	IBM	Data Entry	1
Northern Virginia	IBM 370/138	IBM	Computer	1
	Nova 840	Data General	Computer	2
	2540	IBM	Reader	1
	2540	IBM	Punch	1
	3780	IBM	RJE Terminal	128
	129	IBM	Data Entry	7
	029	IBM	Data Entry	30
	3420	IBM	Tape Drive	4
	Model 10	Wang	Tape Drive	1
	3330	IBM	Disk Drive	1
	3350	IBM	Disk Drive	2
	114	Century	Disk Drive	2
Patrick Henry	2502	IBM	Reader	1
	3521	IBM	Punch	1
	3776	IBM	RJE Terminal	2
	129	IBM	Data Entry	1
	3742	IBM	Data Entry	3
Paul D. Camp	BC7/700	Univac	Computer	1
	0719	Univac	Reader	1
	BC7/700	Univac	RJE Terminal	3
	2780	IBM	RJE Terminal	3
	1610		Data Entry	1
	8408	Univc	Disk Drive	1
Piedmont Virginia	3780	IBM	RJE Terminal	2
	129	IBM	Data Entry	2

Rappahannock	DATA 100	IBM	RJE Terminal	2
	129	IBM	Data Entry	1
	029	IBM	Data Entry	2
Southside Va.	DATA 100		RJE Terminal	2
	029	IBM	Data Entry	2
	129	IBM	Data Entry	2
Southwest Va.	PDP-8		Computer	1
	3781	IBM	Punch	1
	3780	IBM	RJE Terminal	10
	129	IBM	Data Entry	4
			Disk Drive	1
			Tape Drive	1
Thomas Nelson	HP 3000	HP	Computer	1
	2893A	HP	Reader	1
	MOD6	HP	Terminal	31
	029	IBM	Data Entry	5
	129	IBM	Data Entry	1
	7970E	HP	Tape Drive	1
	7920A	HP	Disk Drive	2
Tidewater	HP 3000	HP	Computer	1
	30106A	HP	Reader	1
	DATA 100		RJE Terminal	8
	HP 3000	HP	RJE Terminal	48
	129	IBM	Data Entry	2
	029	IBM	Data Entry	4
	7970E	HP	Tape Drive	2
	7920	HP	Disk Drive	2
	7925	HP	Disk Drive	2
Va. Highlands	NOVA 3/12	DATE GENERAL	Computer	1
	3780	IBM	RJE Terminal	3
	NOVA		Local	25
	129	IBM	Data Entry	2
	029	IBM	Data Entry	1
Va. Western	HP 3000	HP	Computer	1
	30106A	HP	Reader	1
	HP 3000	HP	Terminal	28
	029	IBM	Data Entry	5
	129	IBM	Data Entry	2
	7970E	HP	Tape Drive	1
	7925	HP	Disk Drive	1
	7920	HP	Disk Drive	2
Wytheville	3776	IBM	Terminal	2
	129	IBM	Data Entry	1

	ASSO PROF	DIR	CSD MGR A-C	SYS ANAL A-B	PROG A-B	ADP TECH A-B	ENG A-B	OPER SUPV	COMP OPER A-B	DATA ENTRY A-B	SUB TOTAL
BRCC					1-A					1-A	2
CVCC	*1				1-A			1	1-A 1-B	1-A	6
DSLCC						1-A				1-A	2
DCC					1-A				1-B		2
ESCC									1-A		1
GCC											
JSRCC	*1			1-B	1-A 1-B				1-A 1-B		7
JTCC								1	1-A	1-A	3
LFCC										1-B	1
MECC										1-A	1
NRCC	*1			1-B	2-B					2-A	6
NVCC			1-A	2-A 1-B	3-A 3-B	1-B 1-A		1	4-A 2-B	4-A 1-B	24
PHCC						1-A					1
PDCC								1	2-A	1-A	4
PVCC										1-B	1
RCC						1-A					1
SVCC				1-A						2-B	3
SWCC								1		1-A	2
TNCC	*1			1-A	2-A				1-A		5
TCC	*1				1-A 1-B				1-A 1-B	11-A 3-B	19
VHCC											
VWCC	*1					2-A 1-B			1-A	2-A	7
WCC				1-A						1-A	2
S.O.		1	1-C 3-A	4-B 4-A	2-B 2-A	4-A	1-B 1-A			1-B	24
TOTAL	6	1	5	15	23	12	2	5	19	36	124

* Denotes Administrative Faculty

	CLERK STENO C	CLERK B-D	CLERK TYPIST A-C	AGENCY PERS. SUPV.	SUB TOTAL	TOTAL
BRCC						2
CVCC						6
DSLCC						2
DCC				1	1	3
ESCC						1
GCC			1-C		1	1
JSRCC			1-C		1	8
JTCC						3
LFCC			1-A		1	2
MECC			1-C		1	2
NRCC						6
NVCC						24
PHCC						1
PDCC						4
PVCC						1
RCC						1
SVCC						3
SWCC						2
TNCC						4
TCC		1-B 1-D	1-C		3	21
VHCC		1-D			1	1
VWCC		1-C			1	8
WCC						2
S.O.	1	1-C			2	26
TOTAL	1	5	5	1	12	134

* Denotes Administrative Faculty

Appendix G

POSITION DESCRIPTIONS

The following represents the position levels and types that will be used to staff the VCCS Computing Services function.

DATA ENTRY OPERATOR

Operates various data entry devices to convert and verify data obtained from source documents. Prior to beginning operation, may apply codes to the data being entered. Performs related support duties. Reports equipment malfunctions. Direction and/or supervision is received from a more experienced operator, data entry supervisor or other administrator.

DATA ENTRY LEAD OPERATOR

Serves as a working supervisor for a group of data entry operators. Responsibilities include supervising the operation of data entry devices, training new operators, scheduling and assigning work, and implementing new formats or procedural changes. May serve as a shift supervisor. This class is distinguished from the Data Entry Operator by its supervisory responsibilities, and from the Data Entry Supervisor by the smaller number of operators supervised and participation in the data entry function. Direction and/or supervision is received from a data entry supervisor or other administrator.

DATA ENTRY SUPERVISOR

Supervises a large data entry unit which may include responsibility for more than one shift. Trains employees, schedules and assigns work, identifies and resolves problems, implements new procedures, and evaluates unit

performance. Other duties may include equipment programming, evaluation of new systems or equipment, user interface, and shift supervision. This class distinguished from the Data Entry Operator by the larger number of operators supervised and by more extensive administrative duties which generally preclude participation and resolution of production problems. Typically reports to a production control or other operations supervisor.

PRODUCTION CONTROL TECHNICAN

Controls computer input and output data processed at an operating center or from remote job entry equipment. Logs input data reviewing it for accuracy and completeness. Makes necessary job set-up and control determinations. Takes corrective action to resolve routine problems. Determines validity and disposition of output. Maintains production records. Operates tape cleaning and certifying equipment. May serve as tape librarian. Reports to a higher level production control technician, or other operations supervisor.

PRODUCTION CONTROL LEAD TECHNICIAN

Serves as a working supervisor for a group of production control technicians, or for a combination of data entry, control technician, and computer operator personnel. Provides technical expertise and working supervision for the group. Handles the more involved problems in job set-up, control, and scheduling. May handle or assist in control procedure development. May serve as interface with user and operations groups, or act as shift supervisor. This class distinguished from the Production Control Technician by its level of expertise, and by its supervisory and other administrative responsibilities. Reports to a production control or other operations supervisor.

PRODUCTION CONTROL SUPERVISOR

Supervises a large production control unit, or a combined operations unit composed of data entry, production control and computer operator personnel. Has primary responsibility for coordinating user and operating requirements. Works with systems analysis and programming in developing

production schedules and documenatation. Determines unit operating procedures, staffing and scheduling requirements training needs, etc. Resolves major technical problems. This class is distiguished from the Production Control Lead Technician by the larger and/or more complex, unit supervised. Additionally this class may be responsible for more than one shift. Typically reports to a computer operations or other data processing supervisory person.

COMPUTER OPERATOR

Operates and monitors a computer or remote job entry terminal and peripheral equipment. Sets up input/output equipment by mounting tapes or discs and adjusting controls according to opeating procedures. Monitors peeformance. Locates or assists in locating causes of error stops, and adjusts controls for resumption of processing. Sees to disposition of output. Maintains production and operating records. Reports to a higher level operator or supervisor.

COMPUTER LEAD OPERATOR

Serves as working supervisor for a group of computer operators, or for a combination of data entry operators, production control technician, and computer operators. Supervises and participates in the operation and monitoring of a computer or remote job entry terminal and peripheral equipment. Is responsible for full processing sequence. Trains and assigns to subordinates. Determines the cause of error stops and necessary corrections. Confers with programming or other technical personnel to incorporate changes in instructions or operating sequence. Developes schedules. Reviews operating records. Informs operations supervisor/manager of work progress, and make recommendations. May act as shift supervisor. This class is disstinguished from the Computer Operator by its supervisory responsibilities, and from the Computer Operations Supervisor by the smaller number of persons supervised and by participation in operator functions. Typically reports to an operations supervisor or manager.

COMPUTER CENTER OPERATIONS SPECIALIST

Serves as the senior technical shift specialist in large, complex computer center which utilizes extensive teleprocessing networks, interactive and demand-type systems, together with extensive batch processing. Implements procedures for operation of data communications equipment supporting multiple statewide networks. Monitors and reviews system performance.. Serves as interface with customers for identifying and isolating communications network, processing, or other problems, and initiating corrective action. Starts and stops remote communications lines, and answers RJE operator questions. Provides technical guidance and direction to other computer operators. Confers with superiors on machine scheduling and operating needs, priorities, and telecommunications monitoring. May report to a Computer Operations Supervisor or other technical superior.

COMPUTER OPERATIONS SUPERVISOR

Supervises a computer operations unit composed of a number of data entry, production control, and computer operator personnel, or supervises a large number of computer operators including lead operators. Employs and trains personnel. Plans schedules and work allocations. Reviews equipment and personnel performance. Coordinates operations with programming and systems analysis. Provides technical advice and recommendations. May assist in studies, program testing and installation. This class distinguished from the Computer Lead Operator by the larger number of persons supervised and other administrative duties which usually preclude the supervisor from equipment operation. Also, this class may be responsible for more than one shift. Typically reports to an operations or other manager.

DATA PROCESSING OPERATIONS SUPERVISOR

Supervises the operations function of a large multi-shift installation providing services to multiple users. Responsibilities encompass data entry and control, as well as computer operations. Oversees employment, training and assignment of personnel. Coordinates shift operations. Developes and evaluates operating procedures. Serves as liaison with users for resolving difficulties and providing assistance. May report to a higher level technical supervisor, or to a non-technical agency administrator.

PROGRAMMER TRAINEE

Positions are allocated to this class to provide for on-the-job and classroom training of persons in the analysis of data systems, and in the development and coding of programs for use in computer applications. Training is also received in such areas as machine components and logic, block diagramming and flow charting. As experience is gained, persons are given increasingly complex assignments involving program coding and documentation. Typically, incumbents would receive direction from experienced programmers or a programming supervisor.

PROGRAMMER

Designs, develops and maintains segments of complex programs or complete programs of low to moderate complexity. Translates written or oral instructions into source code in a programming language. Tests programs and evaluates results making corrections as necessary. Documents completed programs. Works independently in flow-charting, coding, testing and in performing other technical functions subject to the review of higher level programming or systems personnel. Reports to a higher level programmer/analyst or other supervisor.

PROGRAMMER/ANALYST

Designs, develops, maintains and enhances computer and related manual systems. Confers with users to define needs. Performs all analytical and programming functions for segments of complex applications, or for complete applications which are less complex. Assignments include the full range of systems development life cycle tasks, but incumbents of this class usually spend a major portion of their time in programming activities. Reports to a senior programmer/analyst or other supervisor.

SENIOR PROGRAMMER/ANALYST

Designs, develops, maintains and enhances complex computer and related manual systems. Confers with users to define needs. Exercise wide latitude in assessing needs and in determining alternatives for satisfying them. May program complex segments or a series of complex segments of a computer programmer, supplying logic and/or physical specifications. May provide direction or supervision to subordinate programmers or programmer analysts, or act as team or project leader. Incumbents of this class may spend a greater portion of their time in either programming or systems analysis depending on the project assigned, or the system development section's current needs. Reports to a sytems development supervisor or other data processing management position.

SYSTEMS ANALYST

Defines user system requirements and translates requirements into computer and related manual system specifications. Confers with user management, department heads, etc. to analyze and document system needs, conduct feasibility studies, and evaluate alternative procedures. Designs systems and specifications to meet needs. May serve as project manager for coordinating between user and data processing personnel, for problem resolution, and for project evaluation and implementation. Determines priorities. Informs management on project progress. Reports to a systems development supervisor or other data processing management position.

PROGRAMMING/SYSTEMS DEVELOPMENT SUPERVISOR

Supervises the systems development function in an agency with a number of programmers and analysts engaged in systems development and maintenance work. Studies user requests, makes personnel assignments, and supervises project planning and scheduling. Reviews analysts' work; and project progress and documentation. Submits status reports to superiors. May serve as project manager in an environment where a number of new systems are in the development stages. May serve as the data processing manager in small or medium size organizations. Reports to higher level data processing manager or agency administrator.

COMPUTER SYSTEMS ENGINEER

Performs duties of average difficulty in providing technical systems hardware/software support services. The work of this class encompasses the following areas: data communications, field engineering, systems control software, configuration analysis, performance measurement, data base administration, and similar technical services. Incumbents customarily perform duties of average difficulty in one specialty while obtaining familiarity in others. Receives direction from higher level technician or other supervisor.

COMPUTER SYSTEMS SENIOR ENGINEER

Performs duties of considerable difficulty in providing technical systems hardware/software. The work of this class covers a range of technical functions spanning such areas as: telecommunications; hardware design; system control software analysis; data base administration; peformance measurement and evaluation; equipment maintenance. Incumbents normally possess comprehensive knowledge in more than one area, and perform duties of considerable complexity. May provide supervision to less experienced technicians. Receives direction from higher level technician or other supervisor.

COMPUTER CENTER LEAD ENGINEER

Serves as an advanced technical specialist in providing systems hardware/software support services at a large computer center utilizing a teleprocessing network to support multiple state agencies. Technical specialization includes systems programming and products, performance measurement and tuning, data networks and communications, data base, simulation/modeling and benchmarking, etc. Works with vendor personnel to obtain support for agency customers. Performs analysis to estimate impact of new standards, procedures, software/hardware, or network configuration changes. Develops and conducts classes for customer agencies and in-house personnel. May report to Computer Systems Chief Engineer or other technical supervisor.

COMPUTER SYSTEMS CHIEF ENGINEER

Provides high level expertise and technical direction for systems hardware/software support services. The work of this class includes responsibility for providing research and analysis, project management, report preparation, documentation, and liaison with other areas in addition to high level expertise and specialization. Incumbents must be specialized in more than one area, and perform highly complex technical duties. Supervisory responsibility for technical personnel may also be required. Reports to top level data processing management, or other high level agency authority.

DP DOCUMENTATION TECHNICIAN

Prepares and maintains systems, programming, data control and operations documentation. Collects and organizes documentation data are directed. Draws flow charts or other diagramming from rough drafts. Writes user instructions. Instructs user on documentation procedures. Organizes and maintains a current documentation library. May assist in establishing documentation standards. May edit basic technical documents. Typically reports to a data processing supervisory person.

DATA PROCESSING OPERATIONS MANAGER

Manages the operations function in an installation where the the existence of a complex hardware configuration - such as a distributed processing network - necessitates statewide coordination, a high level of technical expertise, and interface with a large number and variety of data processors and users. Plans, organizes and directs a combination of data entry, data control, computer operation and remote job entry activities. Provides technical direction the development and implementation of operating procedures. Coordinates user and technical functions, and resolves problems. Assists in budgetary and other management planning and monitoring. May also supervise system engineers. Typically reports to a higher level superior or non-technical agency administrator.

SYSTEMS DEVELOPMENT MANAGER

Plans, organizes and directs all activities relating to systems development in an organization with a large number of programmers and analysts engaged in a variety of complex systems development work. Responsibilities include such functions as hiring and training of staff, project planning and staff assignments, reviewing and evaluating the progress of multiple projects, preparation and presentation of analyses and recommendations to agency management, extensive interface between users and technical staff, coordination of systems design, problem identification and resolution, the establishment of standards, etc. May also supervise some operations personnel. May report to data processing director or other agency management person.

DATA PROCESSING MANAGER

Manages all aspects of an agency data processing activity typically including data entry and control, computer operations, and systems development and engineering. The activity managed usually involves a number of existing and/or developing systems, a network of remote locations, and a sizeable diversified staff. Normally the incumbent is responsible for a range of administrative and technical functions such as planning; budgeting; and formulatring policies, procedures and standards for all aspects of agency data processing. Provides guidance to agency management, and liaison with vendors, user sections, and central state departments. Oversees employment, training, utilization and evaluation of subordinate staff. Customarily reports to a principal agency administrator.

DATA PROCESSING DIRECTOR

Manages all aspects of an agency data processing activity typically including data entry and control, computer operations, and systems development and engineering. The activity managed usually involves a number of complex exisiting and/or developing systems, a network of remote locations, and a large diversified staff. Generally the incumbent is responsible for a range of administrative and technical functions similar to those described for Data Processing Manager, but in an maintenance and operation; communications; staff; and budget. Customarily reports to a principal agency administrator or the agency head.

Appendix H

COST OF EXISTING APPLICATION SOFTWARE

VCCS has developed and implemented application software capable of system-wide use in three separate hardware environments:

1.	Northern Virginia Community College	IBM - DOS/VS
2.	Consolidated Computer Facility	IBM - MVS
3.	Hewlett-Packard User Group	HP - MPE

The application software implemented at the Consolidated Computer Facility will not be included in this cost analysis because the existing environment at the Center will remain entact. The proposed computing environment will focus on student information and reporting; therefore both the Northern Virginia and the Hewlett-Packard User Group efforts will be examined for state-wide implementation.

There has been a considerable investment in systems development in both IBM and HP computing environments throughout the VCCS. Northern Virginia has developed an excellent student information systems in an IBM environment; J. Sargeant Reynolds, Central Virginia, Virginia Western, Thomas Nelson and Tidewater combined to develop a comprehensive student information systems in the HP environment. This appendix estimates the personnel resource invested in existing software.

In summary, Northern Virginia Community College invested $380,000 in data processing personal services. The design cost for the NVCC software development totals $1,016,000 for a combined system development cost of $1,396,000 over a four year period. The investment of data processing personal services in software development at the HP colleges totals $632,500; the design cost is estimated at $83,250 for a combined total system development cost of $915,750 over a three year period. The difference in design cost between the two environments reflects different philosophies involved in the design phase. The detail for the two environments is as follows:

FIGURE H.1

IBM ENVIRONMENT
PERSONNEL RESOURCES

I.	Data Processing Services			
	1. Programming			
		6 people @ 15000/yr for 4 years	$360,000	
	2. Systems/Analyst Time		20,000	
		Total Programming Costs		380,000
II.	Planning, Research and Management			
	1. Full Time for 4 years		80,000	
	2. Part Time for 2 years		20,000	
III.	User Committees			
	Hourly Rate			
	$10 SIS	20 people @ 500 hr/yr(4 yr)	400,000	
	10 CLS	20 people @ 300 hr/yr(4 yr)	240,000	
	8 FAC	10 people @ 200 hr/yr(1 yr)	16,000	
	7 INV	10 people @ 500 hr/yr(4 yr)	140,000	
	10 CEU	10 people @ 300 hr/yr(4 yr)	120,000	
	Total Design Cost			1,016,000
	Total Systems Cost			$ 1,396,000

HP ENVIRONMENT
PERSONNEL RESOURCES

I.	DPS			
	1. Programming			
		10.5 people @ 15000/yr for 3 years	$472,500	
	2. Systems/Analyst Time			
		6 people @ 20000/yr for 3 years	360,000	
		Total Programming Cost		832,500
II.	Design Cost - User Time			
		Total Design Cost	83,250	83,250
	Total Systems Cost			$ 915,750

FIGURE H.2

HP-Programming Cost Distribution

SYSTEM NAME	COST OF PROGRAMMING
Student Information System	$715,000
Admissions	
Registration and Reporting	
Reference Files Maintenance	
Scheduling	
Grade Reporting	
Financial Aid	
Student Accounts Receivable	
Veterans	
Student History	
Graduate Candidate	
Alumni	
Personnel	30,000
Applications Processing	
Equipment Inventory	5,500
Learning Resources	15,000
Serial Control	
Cataloging	
Circulation	
Accounting Systems	
Bookstore	15,000
College Level Accounting	15,000
Institutional Services Accounting	10,000
Supplementary Budgeting and Accounting	10,000
Computer Utilization System	5,000
Faculty Evaluation	2,000
Mass Mailing	
Test Scoring and Evaluation	10,000
Total Cost of Programming	$832,500

FIGURE H.3

IBM-Programming Cost Distribution

SYSTEM NAME	COST OF PROGRAMMING
Student Information System (Admissions, Registration, Student Finances, Graduation, Grading/Transcripts, Student Record-Folder)	$228,000
Course/Schedule Management System	76,000
Facilities Utilization System	19,000
Inventory System	38,000
Continuing Education	19,000
Total Cost of Programming	$380,000

Appendix I

VCCS DISTRIBUTED PLANNING FOR COMPUTING

The following represents the procedure followed in order to determine where the System Offices and college processes/activities can be best supported in the computing network. This represents only the initial study and must become an ongoing process in order to ensure adequate support for the many processes/ activities defined in this Master Plan.

1. Identified functions, processes and activities currently supported at the System Offices and colleges.

2. Identified the major classes of data required to support each process or activity.

3. Identified where data is currently created, used, and stored.

4. Defined possible computing location groups which could best support each process or activity.

   State, Central, Regional, College Campus

5. Categorized the processes and supporting data classes by computing location groups. (See Figure I.3)

6. Determined Qualitative and Service Level Requirements (Q & SL) with appropriate weights.

7. Assigned Q & SL Requirements to each process and data class.

8. Revised categories established in step number 5 based on the implications of Q & SL Requirements.

9. Developed the VCCS Computing Distribution Matrix (see Figure I.4.1 - I.4.5).

10. Developed supporting alternatives and strategies (see Chapter 8).

11. Developed the preliminary network configuration.

12. Developed the final network configuration.

EXAMPLE: DISTRIBUTION MATRIX

Processes/Activities	P/A Location	Q & SL Requirements: Responsiveness	Scheduled Availability	Criticality	Data Volume/ Activity	Activity Frequency	Activity Complexity	Consistency	Independence	Summary	Process Tendency	Computing Location	Q & SL Requirements: Data Classes	Aggregate Data Volume	Data Sharing	Currency	Confidentiality	Immutability	Summary	Data Tendency	Data Base
STUDENT INFORMATION																					
Admissions	C	H	H	H	H	M	H	H	L	21	X	C/R									
Alumni	C	L	L	L	L	L	L	L	H	10	D	C									
Career/Academic	C	L	L	L	L	L	L	L	H	10	D	C									
Financial Aid	C	M	M	H	M	M	M	H	L	17	X	C									
Grading/Transcript	C	M	L	M	M	M	L	H	L	14	X	C									
Graduation	C	L	L	M	L	L	L	H	L	11	X	C									
Health Services	C	M	M	L	L	L	L	L	H	12	D	C									
Job Placement	C	L	L	L	L	L	L	L	H	10	D	C									
Registration	C	H	H	H	H	M	H	H	L	21	X	C/R									
Student Activities	C	L	L	L	L	L	L	L	H	10	D	C									
Student Counseling	C	M	M	M	L	M	L	L	H	14	D	C									

S = CENTRAL
R = REGIONAL
C = COLLEGE

C = CONSOLIDATED
D = DISTRIBUTED
X = CONFLICT

8-24

H = HIGH
M = MEDIUM
L = LOW

S = SYSTEM OFFICES
C = COLLEGES

IMPLICATIONS OF Q & SL REQUIREMENTS

	CONSOLIDATION A/P DATA		DISTRIBUTED A/P DATA*
TIMELINESS			
Responsiveness			✓
Scheduled Availability			✓
Criticality			✓
QUANTITY			
Data Volume/Activity	✓		✓
Activity Frequency			
Activity Complexity	✓		
Aggregate Data Volume		✓	
Data Sharing		✓	
QUALITY			
Currency		✓	
Consistency	✓		
Independence			✓
SECURITY			
Confidentiality		✓	
Immutability		✓	

*Data is neutral

RESULTS OF DISTRIBUTED PLANNING FOR COMPUTING

CENTRAL SUPPORTED PROCESSES

ACCOUNTING
BUDGETING
BUDGET PLANNING
COURSE DICTIONARY
EDUCATIONAL PROGRAMS
DATA ELEMENT DICTIONARY
INDUSTRIAL TRAINING
PAYROLL
PERSONNEL
PURCHASING
STUDENT REPORTING
SYSTEMS DEVELOPMENT
VAIEP
VOC. EDUCATION DATA SYSTEM

REGIONAL SUPPORTED PROCESSES

ACCOUNGING-LOCAL FUNDS
ANALYTICAL REPORTING
ACADEMIC COMPUTING
ENROLLMENT PROJECTIONS
EQUIPMENT INVENTORY
FACILITIES INVENTORY
FACILITIES UTILIZATION
INSTITUTIONAL RESOURCE
LEARNING RESOURCES
STUDENT FOLLOW-UP
STUDENT RETENTION
STUDENT & ENROLLMENT CHAR.
SYSTEMS DEVELOPMENT

COLLEGE SUPPORTED PROCESSES

CLASS SCHEDULE
CONTINUING EDUCATION
COURSE MANAGEMENT
EDUCATION/TRAINING DEVL.
FOUNDATIONS
LEAVE MANAGEMENT
PRODUCTIVITY ANALYSIS
PUBLIC SERVICES ACTIVITIES
STUDENT INFORMATION
SUPPLIES INVENTORY

VCCS COMPUTING DISTRIUBTION MATRIX

Processes/Activities	P/A Location	Q & SL Requirements									Process Tendency	Computing Location	Q & SL Requirements							
		Responsiveness	Scheduled Availability	Criticality	Data Volume/ Activity	Activity Frequency	Activity Complexity	Consistency	Independence	Summary			Data Classes	Aggregate Data Volume	Data Sharing	Currency	Confidentiality	Timeliness	Summary	Data Tendency
STUDENT INFORMATION																				
Admissions	C	H	H	H	H	M	H	H	L	21	X	C/R								
Alumni	C	L	L	L	L	L	L	L	H	10	D	C								
Career/Academic	C	L	L	L	L	L	L	L	H	10	D	C								
Financial Aid	C	M	M	H	M	M	M	H	L	17	X	C								
Grading/Transcript	C	M	L	M	M	M	L	H	L	14	X	C								
Graduation	C	L	L	M	L	L	L	H	L	11	X	C								
Health Services	C	M	M	L	L	L	L	L	H	12	D	C								
Job Placement	C	L	L	L	L	L	L	L	H	10	D	C								
Registration	C	H	H	H	H	M	H	H	L	21	X	C/R								
Student Activities	C	L	L	L	L	L	L	L	H	10	D	C								
Student Counseling	C	M	M	M	L	M	L	L	H	14	D	C								
Student Finances	C	M	M	H	M	M	L	H	L	16	D	C								
Student Obligations	C	L	L	L	L	L	L	L	H	10	D	C								
Student Record Folder	C	L	L	M	M	M	L	L	H	13	D	C								
Veteran	C	L	L	H	M	M	L	H	L	14	D	C								

Processes/Activities	P/A Location	Q & SL Requirements									Process Tendency	Computing Location	Q & SL Requirements							
		Responsiveness	Scheduled Availability	Criticality	Data Volume/ Activity	Activity Frequency	Activity Complexity	Consistency	Independence	Summary			Data Classes	Aggregate Data Volume	Data Sharing	Currency	Confidentiality	Immutability	Summary	Data Tendency
COURSE/SCHEDULE MANAGEMENT																				
Course Dictionary	C/S	H	H	H	L	H	L	H	L	18	X	S/R								
Course Management	C	H	M	M	L	M	M	L	H	13	D	C								
Class Schedule	C	H	L	H	L	L	L	L	H	14	D									
COMMUNITY EDUCATION																				
Continuing Education	C	M	M	M	M	M	M	L	H	16	D	C								
Public Services Activities	C	L	L	L	L	L	L	L	H	10	D	C								
LEARNING RESOURCES																				
Acquisition	C	M	M	M	H	L	H	H	L	17	X	R								
Cataloging	C	M	M	M	H	L	H	H	L	17	X	R								
Circulation	C	M	M	M	H	L	L	L	H	15	D	R								
Serial Control	C	H	H	M	H	M	L	L	H	18	D	R								
FACILITIES MANAGEMENT																				
Facilities Inventory	C	L	L	L	L	L	L	H	L	10	C	R								
Facilities Utilization	C	L	L	M	M	L	M	H	L	13	C	R								

Processes/Activities	P/A Location	Q & SL Requirements: Responsiveness	Scheduled Availability	Criticality	Data Volume/ Activity	Activity Frequency	Activity Complexity	Consistency	Independence	Summary	Process Tendency	Computing Location
Accounting - FAS	C/S	L	L	H	H	H	H	H	L	18	C	S
Accounting - Local Funds	C	L	L	H	M	M	M	L	H	16	D	R
Budgeting	C/S	L	L	H	M	L	H	H	L	15	C	S
Budget Planning	C/S	L	L	H	M	L	H	H	L	15	C	S
Equipment Inventory	C/S	L	L	L	M	L	M	M	L	11	C	R
Supplies Inventory	C/S	L	L	L	H	M	M	L	H	14	D	C
Payroll	C/S	M	M	H	M	M	H	H	L	18	C	S
Personnel												
Applicant Processing	C/S	M	L	M	H	M	H	H	L	17	C	S
Personnel Management	C/S	M	L	H	M	M	H	H	L	17	C	S
Organization & Position Mgt.	C/S	L	L	H	L	L	H	H	L	14	C	S
Leave Management	C/S	H	H	H	L	H	L	L	H	18	D	S/C
Education/Training Development	C/S	L	L	L	L	L	L	L	H	10	D	S/C
Purchasing	C/S	M	M	M	M	M	M	H	L	16	X	S

Q & SL Requirements: Data Classes; Aggregate Data Volume; Data Sharing; Currency; Confidentiality; Immutability; Summary; Data Tendency

I.4.4

VOCS COMPUTING DISTRIBUTION MATRIX

Processes/Activities	P/A Location	Q & SL Requirements									Process Tendency	Computing Location
		Responsiveness	Scheduled Availability	Criticality	Data Volume/ Activity	Activity Frequency	Activity Complexity	Consistency	Independence	Summary		
Analytical Reporting	C/S	L	L	M	H	L	H	H	L	15	C	R
Faculty Productivity Analysis	C	L	L	H	H	L	H	H	L	16	C	R
Foundations	C	L	L	M	L	L	L	L	H	11	D	C
Enrollment Projections	C/S	H	L	H	H	L	H	H	L	16	C	R
Institutional Resources	C/S	L	L	H	H	L	H	H	L	16	C	R
Student Follow-up	C/S	L	L	M	L	L	M	M	L	11	C	R
Student Retention	C/S	L	L	M	L	L	M	M	L	11	C	R
Student and Enrollment Char.	C/S	L	L	M	L	L	M	M	L	11	C	R
Facilities Utilization Analysis	C/S	L	L	M	M	L	M	M	L	12	C	R

Q & SL Requirements
- Data Classes
- Aggregate Data Volume
- Data Sharing
- Currency
- Confidentiality
- Immutability
- Summary
- Data Tendency

Processes/Activities	P/A Location	Q & SL Requirements									Process Tendency	Computing Location
		Responsiveness	Scheduled Availability	Criticality	Data Volume/ Activity	Activity Frequency	Activity Complexity	Consistency	Independence	Summary		
ACADEMIC COMPUTING												
Instruction Data Processing	C	H	H	H	H	H	M	L	H	21	D	R
Computer Managed Instruction	C	H	H	H	M	M	M	L	H	19	D	R
Computer Assisted Instruction	C	H	H	H	M	M	M	L	H	19	D	R
Problem Solving	C/S	L	L	L	L	L	H	L	H	12	X	R
Tutorial Instruction	C/S	M	M	M	M	M	M	L	H	16	D	R
Simulation	C/S	L	L	L	L	L	H	L	H	12	X	R
Educational Programs	S	L	L	L	M	L	M	H	L	12	C	S
Special Training	S	L	L	L	M	L	M	H	L	12	C	S
Student Reporting	S	L	L	H	H	L	H	H	L	16	C	S
VAIEP	S	L	L	H	H	L	H	H	L	16	C	S
Voc. Education Data System	S	L	L	H	H	L	H	H	L	16	C	S
Data Element Dictionary	C/S	M	M	H	H	M	H	H	L	19	C	S

Q & SL Requirements
Data Classes
Aggregate Data Volume
Data Sharing
Currency
Confidentiality
Immutability
Summary
Data Tendency

Appendix J

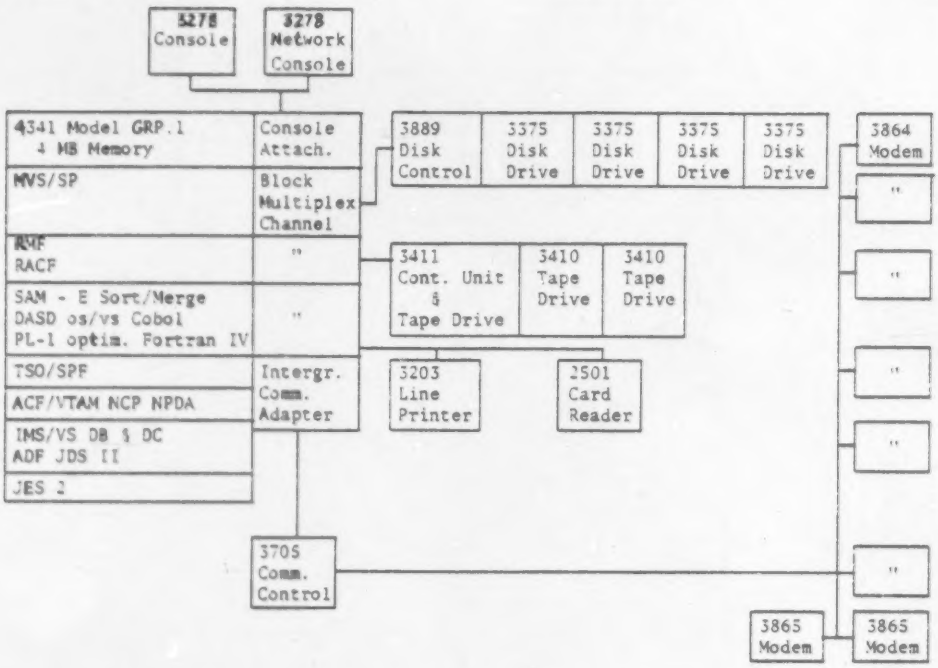
RECOMMENDED NETWORK CONFIGURATION

Alternative 1

No.	Type	Equipment
1	Central Host	IBM 158 Equivalent
2	Regional Centers	IBM 148 Equivalent
10	College Centers	IBM 138 Equivalent
13	College Remotes	IBM 3776 or 77 Equivalent
11	Campus Remotes	IBM 3776 or 77 Equivalent

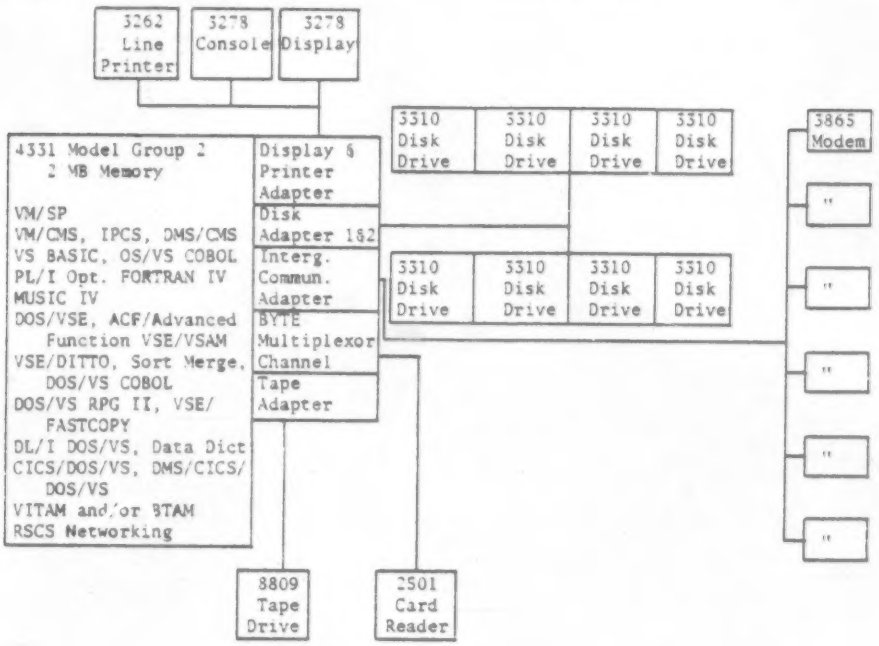
The following cost represent the detail costs for the three alternatives that were considered. Figures J.1 through J.4 are the detailed costs for all four levels of the recommended Alternative 1. Figures J.5 and J.6 are the detailed costs for the Hewlett-Packard configuration that are not being recommended at Levels 3 and 4.

Figure J.1 - Recommended Alternative



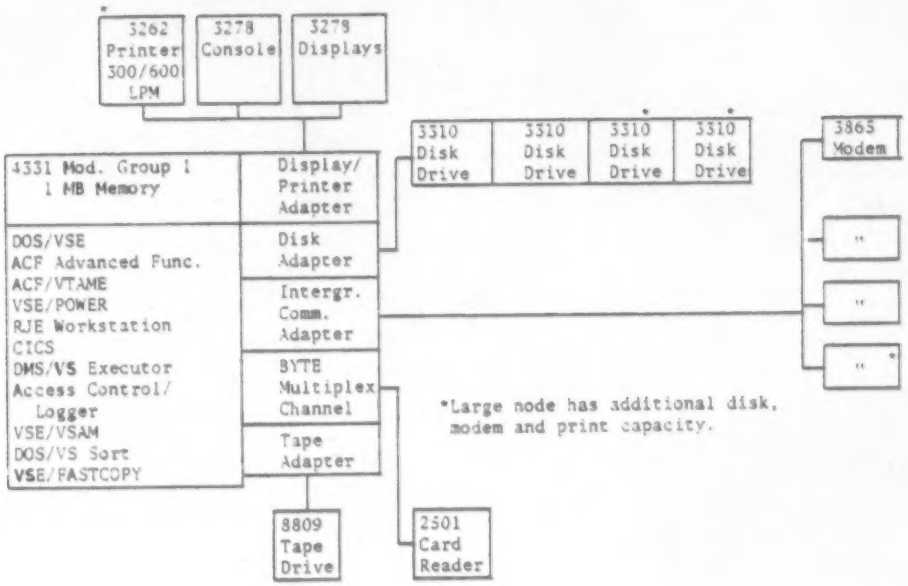
UNIT	QTY.	DESCRIPTION	LEASE	PURCHASE	MMC
4341	1	Processor - 4MB	6790.50	259,785.00	594.00
3279	1	Display Console	96.30	3,384.00	31.50
2501	1	Card Reader	401.81	16,173.00	116.00
3203	1	Line Printer	1327.50	34,488.00	391.00
3880	1	Storage Control Unit	1613.70	68,251.50	187.00
3375	2	Disk Storage Units	2136.60	90,981.00	263.00
3411	1	Control Unit & Megnetic Tape	678.60	20,997.00	157.00
3410	2	Magnetic Tape Units	561.60	17,748.00	183.00
3705	1	Communications Controller	2079.90	54,926.00	367.50
1417	2	Train Cartridge	214.54	5,031.00	
3865	2	9600/4800 BPS Modems	408.60	13,251.60	86.00
3864	6	4800/2400 BPS Modems	658.80	22,005.00	138.00
3278	1	Network Console	64.80	2,667.50	16.00
			17033.25	609,688.60	2530.00

Figure J.2 - Recommended Alternative LEVEL 2 REGIONAL



UNIT	QTY	DESCRIPTION	LEASE	PURCHASE	MMMC
4331	1	Processor - 2MB	4923.90	176,052.60	288.00
3278	1	Display Console	96.30	3,384.00	31.50
2501	1	Card Reader		16,173.00	116.00
3262	1	Line Printer	356.40	14,067.00	157.00
3310	4	Disk Storage Units	2259.00	80,064.00	383.00
8809	1	Magnetic Tape Unit	292.50	10,350.00	55.00
3278	13	Display Stations	842.40	34,222.50	208.00
3865	6	9600/4800 BPS Modem	1036.80	33,166.80	201.00
			9807.30	367,479.90	1439.50

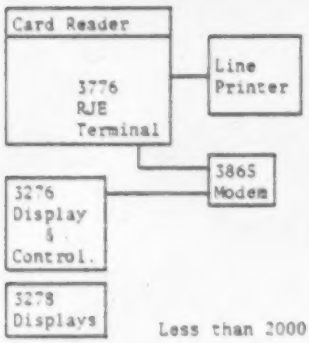
Figure J.5 - Recommended Alternative LEVEL 3 COLLEGE



UNIT	QTY	DESCRIPTION	LEASE LARGE	LEASE SMALL
4311	1	Processor	2477.70	2398.50
3278	1	Display Console	96.30	96.30
2501	1	Card Reader		
3262	1*	Line Printer	356.40	251.10
3310	1/2	Disk Storage Units	1129.50	603.00
8809	1	Magnetic Tape Unit	292.50	292.50
3278	13	Display Stations	842.40	842.40
3865	3/4*	9600/4800 BPS Modems	691.20	518.40
			5886.00	5002.20

*Large node has additional disk, modem and printing capacity.

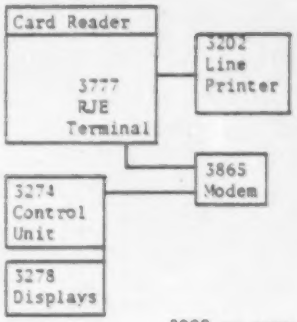
Figure J.4 - Recommended Alternative LEVEL 4 COLLEGE/CAMPUS REMOTE



Less than 2000 students

UNIT	QTY	DESCRIPTION	LEASE
3776	1	RJE,CARD READER and Line Printer	681.30
3276	1	Display Station and Control Unit	196.20
3278	7	Display Stations	453.60
3865	1	Modem 9600/4800 BPS	184.00
			1515.10

Purchase = 53,393.40

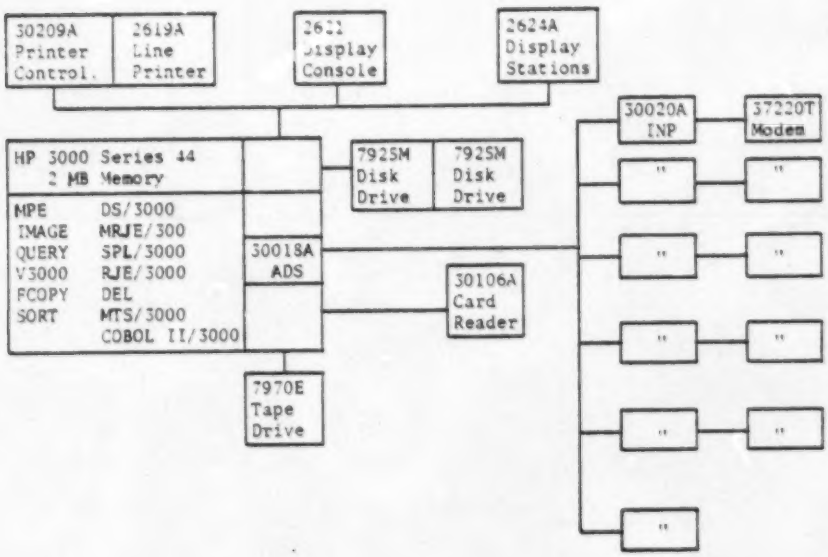


2000 or more students

UNIT	QTY	DESCRIPTION	LEASE
3777	1	RJE,CARD READER and Line Printer	1603.80
3274	1	Control Unit	162.00
3278	13	Display Stations	842.40
3865	1	Modem 9600/4800 BPS	184.00
			2792.20

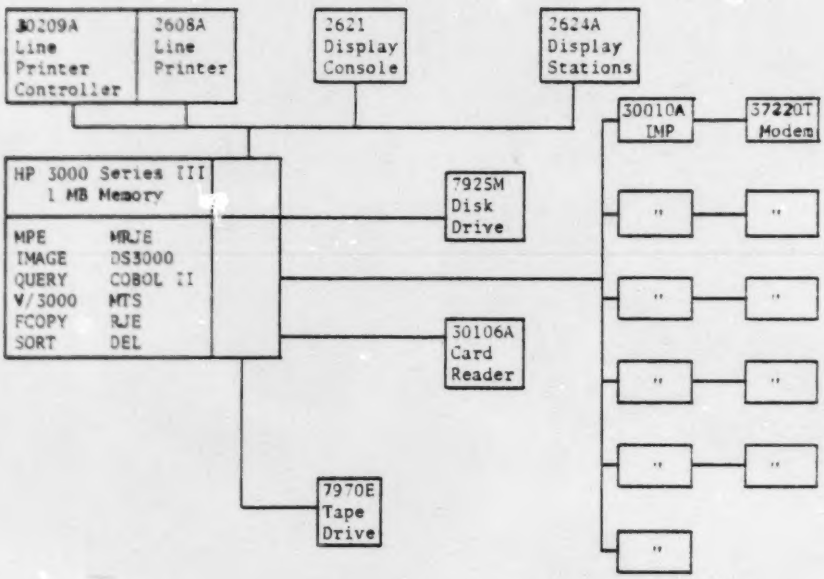
Purchase = 94,864.40

Figure J.5 - Hewlett Packard Alternative LEVEL 3 COLLEGE/LARGE



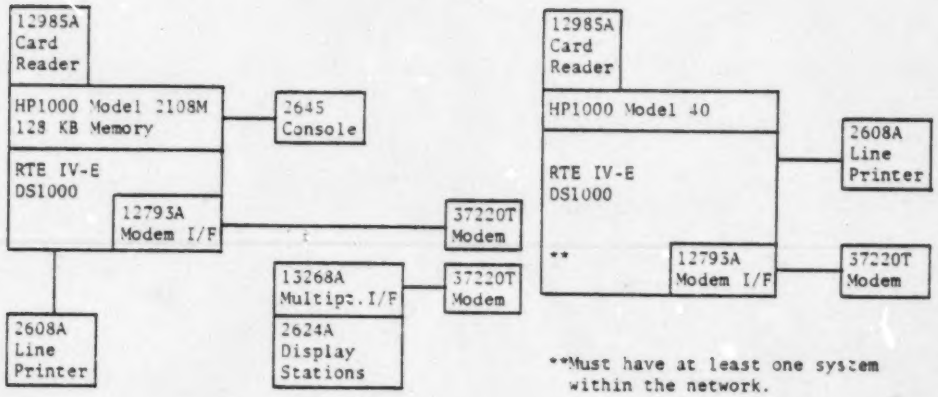
UNIT	QTY	DESCRIPTION	PURCHASE	MMC
Series 44	1	Processor - 2MB	93,100.00	1,313.00
2621	1	Display Console	1,570.00	20.00
30106A	1	Card Reader	7,700.00	101.00
30209A	1	Printer Controller	1,275.00	5.00
2619A	1	Line Printer w/Interface	25,350.00	570.00
7925M	2	Master & Slave Disk Drive	39,000.00	164.00
7970E	1	Magnetic Tape Unit w/1st Master	11,910.00	84.00
2624A	13	Display Stations w/Cable (13222N)	36,725.00	312.00
37220T	5	9600 BAUD Modem	30,750.00	200.00
30020A	6	Intelligent Network Processors	27,000.00	228.00
30018A	1	Asynchronous Data Comm.	1,600.00	9.00
			275,980.00	3,009.00
		Less Discount	-46,593.70	
			229,386.30	

Figure J.3.1 - Hewlett Packard Alternative LEVEL 3 COLLEGE



UNIT	QTY	DESCRIPTION	PURCHASE	MMC
Series III	1	Processor - IMB	71,795.00	475.00
2621	1	Display Console	1,570.00	20.00
30106A	1	Card Reader	7,700.00	101.00
30209A	1	Printer Controller	1,275.00	5.00
2608A	1	Line Printer w/Interface	10,850.00	149.00
7925M	1	Master Disk Storage Unit	21,000.00	99.00
7970E	1	Magnetic Tape Unit w/1st Master	11,910.00	87.00
2624A	13	Display Stations w/Cable (13222N)	36,725.00	312.00
37220T	5	9600 BAUD Modem	30,750.00	200.00
30010A	6	Intelligent Network Processors	27,000.00	222.00
			220,575.00	1669.00
		Less Discount	-40,784.75	
			179,790.25	

Figure J.6 - Hewlett Packard Alternative LEVEL 4 COLLEGE/CAMPUS REMOTE



**Must have at least one system within the network.

UNIT	QTY	DESCRIPTION	PURCHASE LARGE	PURCHASE SMALL	SMME LARGE	SMME SMALL
2108M	1	Computer - 128KB	9600.	9600.	419.00*	419.00*
2645	1	Console	5340.	5340.		
12985A	1	Card Reader	6375.	6375.		
2608A	1	Line Printer	8892.	8892.		
12793A	1	Modem Interface	1800.	1800.		
2624A	8-13	Display Stations w/Cable	36725.	22600.	312.00	192.00
13268A	8-13	Multipt. Interface	4875.	300.	39.00	24.00
37220T	2	9600 BAUD Modems	12300.	12300.	80.00	80.00
92068E	1	RTE IV-E Operating System	1500.	1500.		
DS1000	1	Network Software	1600.	1600.		
			88944.	72944.	850.00	715.00
		Less Discount	-13351.	-10311.		
			75593.	62633.		

*Includes all software and peripherals

APPENDIX K

HP/NVCC SIS DEVELOPMENT STATUS AND CONVERSION TIMETABLE

Subsystem/Module	Operational by June 1, 1981 NVCC	Operational by June 1, 1981 H-P Colleges	Conversion Timetable NVCC	Conversion Timetable H-P Colleges
Student/Alumni:				
Admissions	yes	yes	9-1-81	9-1-81
Registration	yes	yes	9-1-81	9-1-81
Student Record-Folder				
Preparation	no	yes	---	6-1-82
Tracking	yes	no	6-1-82	---
Student Finances	yes	yes	6-1-82	6-1-82
Financial Aid	no	yes	---	6-1-82
Veterans	no	yes	---	6-1-82
Counseling				
Testing	yes	no	6-1-82	---
Program Placement	yes	no	6-1-82	---
Advising Profile	no	yes	---	6-1-82
Grading/Transcripts	yes	yes	6-1-82	6-1-82
Health Services	no	no	6-1-82	---
Graduation	yes	yes	6-1-82	6-1-82
Job Placement	no	no	---	---
Alumni	no	no	---	---
Student Obligations	yes	yes	9-1-81	9-1-81
Career-Academic	no	no	---	---
International Students	yes	yes	6-1-82	6-1-82
Student Activities	no	no	---	---
Student History	yes	yes	9-1-81	6-1-82
Community Education:				
Continuing Education (CEU)	yes	no	6-1-82	---
Public Services Activities	no	no	---	---
Course/Schedule Management:				
Course Dictionary	yes	yes	9-1-81	9-1-81
Course/Schedule Management	yes	yes	9-1-81	9-1-81
Quarterly Class Schedule	yes	yes	9-1-81	9-1-81
Facilities Management:				
Facilities Inventory	yes	yes	9-1-81	9-1-81
Facilities Utilization	yes	yes	9-1-81	9-1-81
Faculty Workload Management:	no	yes	---	6-1-82
Software Integrated with SIS Conversion				
SIP Interface	no	yes	---	9-1-81
AKT Interface	yes	no	9-1-81	---
Census Reporting	yes	yes	9-1-81	6-1-82

Appendix L

GLOSSARY - DATA PROCESSING TERMS

To assist in further clarifying the strategy outlined in this section, the following definitions are provided:

Acquisition	- Purchasing, leasing or sharing software developed outside of the VCCS.
Development	- Designing and creating software.
Distributed Processing	- Information processing where the computing capability and data are located as close to the user as is practical while at the same time retaining the ability to consolidate and store this information through data communications network facilities.
Enhancement	- Improving existing software to include minor systems development.
Hardware	- Physical computer equipment, e.g., mechanical, magnetic, electrical, or electronic devices.
Maintenance	- Correcting deficiencies in existing software.
Network	- A computer communications system consisting of one or more terminals communicating with a single host computer system, which acts as the network control component through internal programming. The chief characteristic of a network is the single, controlling host computer system, which may include multiple processors.
Networking	- Connecting geographically separated computers together over transmission lines. This allows computers to ship data to each other or ship jobs around (either in case of overload or because one of the computers has the necessary computer programs or data to do a particular job.
Shared Development	- A systematic process which converts VCCS user requirements into programs or procedures

utilizing the gross resources of the system. Implicit in this process is a continuing central evaluation of the effectiveness, accuracy, and credibility of the products produced.

Software - A term coined to contrast computer programs with the "iron" or hardware of a computer system. Software programs are stored sets of instructions which govern the operation of a computer system.

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